CSM Unit 1, Upper Watersheds

Pine Creek

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ABBREVIATIONS AND ACRONYMS

AWQC	ambient water quality criteria
BLM	Bureau of Land Management
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cfs	cubic foot per second
CIA	Central Impoundment Area
COPC	chemical of potential concern
CSM	conceptual site model
CV	coefficient of variation
DMEA	Defense Minerals Exploration Program
EPA	U.S. Environmental Protection Agency
EV	expected value
FS	feasibility study
IDEQ	Idaho Division of Environmental Quality
MFG	McCulley, Frick & Gilman, Inc.
µg/L	microgram per liter
msl	mean sea level
PDF	probability density function
PineCrkSeg	Pine Creek segment
PRG	preliminary remediation goal
RI	remedial investigation
RI/FS	remedial investigation/feasibility study
SL	screening level
South Fork	South Fork Coeur d'Alene River
TMDL	total maximum daily load
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
WRCC	Western Regional Climate Center

1.0 INTRODUCTION

The Pine Creek Watershed is located within the Coeur d'Alene River basin and is a north-flowing tributary of the South Fork Coeur d'Alene River (South Fork). The Bureau of Land Management (BLM) has identified 131 source areas (e.g., mining waste rock dumps, adits, and jig tailings piles) within the watershed (BLM 1999). The watershed has been affected by mining activities, and past and continuing releases of metals from mining wastes.

Several time-critical and non-time critical clean-up responses have been implemented by the Bureau of Land Management on public lands in the Pine Creek watershed. In the 1996 and 1997 field seasons under a time-critical removal, two tailings ponds associated with the Douglas mine and mill site were removed from the east fork of Pine Creek (USEPA, 1996). Approximately 25,000 cubic yards of materials were removed and placed into a temporary repository near the mine (Fortier, 2000). Following the flooding in 1996 and 1997, funding by the Federal Emergency Management Agency was used to conduct time-critical removals of approximately 23,000 cubic yards of contaminated soils and tailings from the Amy-Matchless, the Liberal King, and a portion of the Denver Creek tailings piles (BLM, 1998). These materials were initially removed to a Temporary Storage area at the Upper Constitution Mill site, and then in 1998, were relocated from the Temporary Storage Area to the Central Impoundment Area (CIA) within the Bunker Hill Site.

Following these time-critical removals, additional non-time critical removals were performed in 1998 at the Amy Matchless site, and at the Liberal King Site. About 2,200 cubic yards of tailings were removed to the CIA as a part of this action. These areas were then re-graded, soil media was imported, and the disturbed areas at these sites were re-vegetated. BLM plans additional actions to cleanup the mill site in 2000, along with a pilot treatment system for the adit drainage (Fortier, 2000).

In the 1998 and 1999 field seasons, contaminated soils from around the mill at the Upper Constitution were also excavated and disposed of in the CIA. A subsurface wetlands treatment facility to address adit and seep drainage was installed at this site in 2000; however, most of the tailings, and the waste rock dump at this site are located on private land, and have not been addressed to date.

A CERCLA non-time critical action was also implemented at the Sidney (Red Cloud) mine and mill site during the 1998, 1999, and 2000 field seasons. This action included removal of contaminated soils from around the mill site, regrading the waste rock dump, installation of run-on and run-off controls and on-site culvert improvements. Excavated soils were disposed of in the CIA. BLM has plans to close the adit and treat the drainage in a wetlands treatment system (Fortier, 2000).

In the 1999 field season, Highland Creek was also diverted around the waste rock dump at the Highland Surprise mine and mill site in order to reduce erosion. As most of the facilities at this site are on private land, no other actions have been taken to date. In addition, EPA correspondence indicated the removals of about 600 cubic yards of contaminated sediment from the Hilarity Mine, about 4,300 cubic yards from the Little Pittsburg site, and 5,200 mixed waste rock from the Nevada Stewart Mine site for disposal at the CIA (CH2MHILL, 1998).

In 1995, the private owner of the Nabob Mine property installed a soil cover over the tailings pile and a portion of the mill area. The cover was revegetated with limited success (BLM, 1998). In the 1998 and 1999 field seasons, BLM implemented channel improvements through this reach to help stabilize the channel and prevent erosion of the tailings pile embankment. Stream channel stabilization, including barbs and in-stream structures have been implemented since 1997 in Denver Creek and the East Fork of Pine Creek to improve riparian habitat (Stevenson, 1998).

This watershed is one of eight watersheds assigned to conceptual site model (CSM) Unit 1, Upper Watersheds (see Part 1, Section 2, Conceptual Site Model Summary). The watershed itself has been divided into three segments to focus this investigation (Figure 1.1-1). Brief descriptions of each segment are presented in this section.

1.1 SEGMENT DESCRIPTIONS

Segment 1 contains the headwaters of the East Fork of Pine Creek down to its confluence with the main stem of Pine Creek (Figure 4.1-1). The BLM identified 78 source areas in this segment. Extensive stream channel and floodplain remediation activities have been conducted in this segment. Some mining wastes have been removed from BLM lands and taken out of the watershed to the Central Impoundment Area near Kellogg. However, at several of the mines and mill sites where work was done by BLM, wastes remain on private land. Some of these wastes may be discharged by ongoing erosion to the creek during high flows. Sampling of surface water indicates that metals concentrations are greater than ambient water quality criteria (AWQC). Fish populations are dominated by brook trout, with native cutthroat trout making up a small proportion of the samples collected during one year, and absent the following year. Sculpin were not encountered at any location during sampling, reflecting their sensitivity to anthropogenic impacts and water quality.

Segment 2 contains the headwaters of Pine Creek (including the West Fork of Pine Creek) up to its confluence with the East Fork (Figure 4.1-4). The BLM identified 30 source areas in this segment. The majority of these are small, undeveloped prospects or mines. No tailings deposits were identified. Sampling of surface water indicates that metals concentrations in surface water are rarely greater than AWQC. Though this segment has been subject to little mining-related activity, other anthropogenic impacts, including residential development, forest roads, and timber harvest, are present.

Segment 3 begins at the confluence of the East Fork with the main stem of Pine Creek and continues to the confluence of Pine Creek with the South Fork (Figure 4.1-5). The BLM identified 23 source areas in this segment. As with Segment 1, some mining wastes have been removed from BLM lands; however, some removals from BLM land did not include wastes on adjacent private land, and waste remains in place with possible or ongoing erosion to the creek. Sampling of surface water indicates that metals concentrations in surface water are greater than AWQC. The lower portion of this segment lies within the town of Pinehurst. The stream system in this area has some development. There is extensive channelization and limited riparian vegetation. As with Segment 1, fish populations are dominated by brook trout, with native cutthroat trout making up a small proportion of the samples collected during one year, and absent the following year. Sculpin were not encountered at any location during sampling, reflecting their sensitivity to anthropogenic impacts and water quality.

1.2 REPORT ORGANIZATION

The remedial investigation report is divided into seven parts. This report on the Pine Creek Watershed is one of eight reports contained within Part 2 presenting the remedial investigation (RI) results for the eight CSM Unit 1 upper watersheds. The content and organization of this report are based on the U.S. Environmental Protection Agency's (EPA) *Guidance Document for Conducting Remedial Investigations and Feasibility Studies under CERCLA, Interim Final* (USEPA 1988). This report contains the following sections:

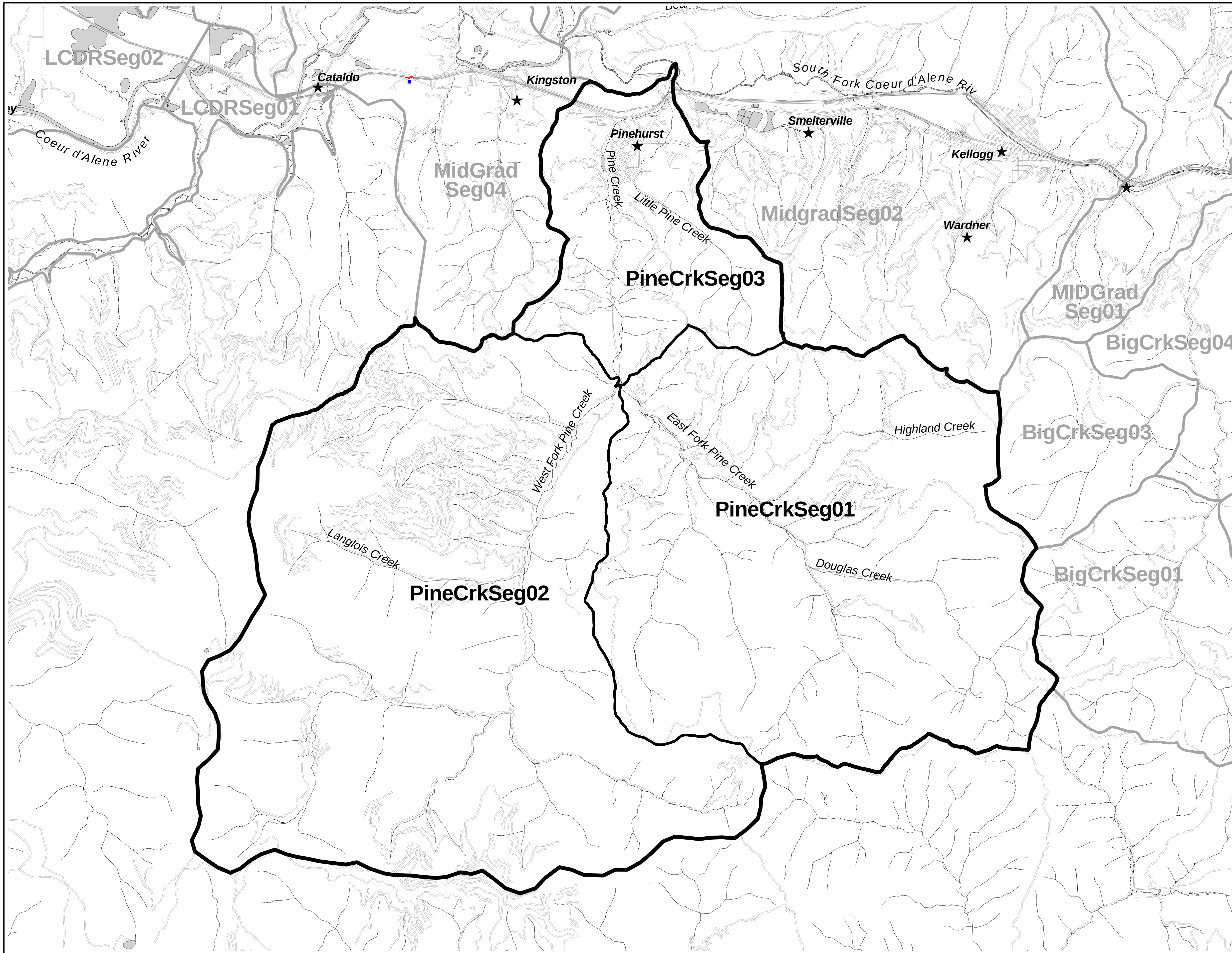
- Section 2–Physical Setting, includes discussions on the watershed's geology, hydrogeology, and surface water hydrology.
- Section 3–Sediment Transport Processes
- Section 4–Nature and Extent of Contamination, includes a summary of chemical results and estimates of mass loading from source areas

- Section 5–Fate and Transport, includes chemical and physical transport processes for metals

- Section 6–References

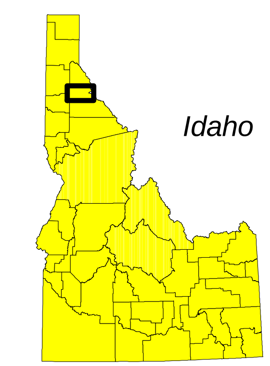
Risk evaluations and potential remedial actions associated with source and depositional areas are described in the human health risk assessment, the ecological risk assessment, and the feasibility study (all under separate cover).

Figure 1.1-1
Pine Creek Watershed



LEGEND

- Stream
- Road
- Interstate-90
- City
- Pine Creek Watershed
- Pine Creek Segment
- River Segment
- Lake/River



Location Map

NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.

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Coeur d'Alene Basin RI/FS
RI REPORT

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V:Pine Creek
E:Pine Creek
L: Final RI Pine Creek
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This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: July 13, 2001

2.0 PHYSICAL SETTING

2.1 GEOLOGY AND MINES

The geology and mining history of the Pine Creek Watershed are presented in this section.

2.1.1 Geomorphic Setting

The Pine Creek Watershed is located 5 miles west of Kellogg on the south side of the South Fork and drains an area of approximately 60 square miles (Figure 1.1-1) (Quivik 1999). Pine Creek, the principal drainage of the watershed, discharges to the South Fork just upstream of the confluence with the North Fork Coeur d'Alene River (North Fork). East Fork Pine Creek and West Fork Pine Creek begin at an elevation of approximately 5,400 feet in the St. Joe Mountains and join approximately 4 miles south of Pinehurst to form the main stem of Pine Creek.

East Fork Pine Creek, West Fork Pine Creek, and main stem flow northerly. In headwater areas the canyons are narrow. West Fork Pine Creek is flanked by steep hillsides in the reach immediately above the confluence with the East Fork. In the lower portion of the main stem, the floodplain broadens (0.75 mile wide).

2.1.2 Bedrock Geology

The Pine Creek Watershed is mostly underlain by weakly metamorphosed sedimentary rocks assigned to the Precambrian Belt Supergroup (Part 1, Figure 3.2-1). The Prichard Formation is by far the most prevalent formation in the watershed. The Prichard consists of either argillite (more common in the lower part of the formation) or quartzite (more common in the upper part). The Burke Formation (mainly a quartzite) is the predominant formation at the headwaters of East Fork Pine Creek and West Fork Pine Creek (Part 1, Figure 3.2-1). Near Pinehurst to the west of Pine Creek, a small area of outcropping quartzite is assigned to the Ravalli Group, which is a combination of the Revett and Burke Formations (Part 1, Figure 3.2-1).

Waste rock piles are present at all mine workings in the Pine Creek Watershed. Waste rock consists of broken, angular rock that is generally unmilled and typically dumped near the mouth of workings. The largest waste rock piles in the watershed are at the Sidney (Red Cloud), Sidney (Denver), Constitution, and Nabob Mines (Box, Bookstrom, and Kelley 1999). The chemical and mineralogical content of waste rock is discussed further in Section 4, Nature and Extent of Contamination.

2.1.3 Structural Geology

Roughly east-west-trending faults dominate the structural fabric of the watershed. The Osburn Fault is the principal structure of the district, and other large faults mimic the trend of the Osburn Fault. Aside from the Osburn, the most prominent east-west faults are the Placer Creek and Ross Faults (located near the confluence of East Fork and West Fork), and the Spring Fault (located about 1 mile south of Pinehurst). Both normal faults and reverse faults are common in the watershed and are differentiated from one another on the basis of movement on either side of the fault plane. Dip-slip movement along the fault plane yields displacement on the order of hundreds of feet (Umpleby and Jones 1923). Both the Osburn and Placer Creek Faults display right-lateral movement.

The Liberal King (Sunset) Mine (also referred to as the Sunset Minerals Mine [Part 1, Figure 3.2-3]) is localized along an east-west-trending fault zone. Although east-west structures are most prevalent, it appears that northwest-trending structures are associated with the following mines: Constitution, Douglas, Sydney (Red Cloud), Highland-Surprise, and Nabob, all located along smaller drainages discharging to the East Fork (Gott and Cathrall 1980). In addition to northwest-trending faulting, the Pine Creek Anticline crosses Pine Creek at the intersection of East Fork and West Fork, and weakly metamorphosed Belt Supergroup sedimentary rocks are folded along the northwest-trending axis of the anticline (Part 1, Figure 3.2-3).

2.1.4 Soils

Like most of the soils throughout the district, the soils of the Pine Creek Watershed can be grouped into two broad categories: hillside soils and valley soils. Hillside soils typically consist of silty loam with variable amounts of gravels and clay, generally less than 2 feet thick (MFG 1992; Camp Dresser & McKee 1986). Valley soils are found within and along the flanks of the major drainages of the Pine Creek Watershed.

The valley soils are most extensive in the floodplain located in the town of Pinehurst, and along West Fork Pine Creek, just above the confluence with East Fork Pine Creek (see Part 1, Figure 3.2-1, symbol Qal). Soils within and flanking the channels at these two locations typically consist of well-developed sandy soil overlying cobbly to bouldery gravels (Box, Bookstrom, and Kelley 1999). Deposits of alluvial fan gravels are also found in West Fork Pine Creek, just above the confluence with East Fork Pine Creek.

West and east of the town of Pinehurst is an extensive area of terrace gravels, which are characterized by well-developed sandy soil overlying cobbly to bouldery gravels (Box, Bookstrom, and Kelley 1999). Smaller masses of terrace gravels are scattered along East Fork Pine Creek and West Fork Pine Creek (Part 1, Figure 3.2-1).

2.1.5 Ore Deposits

The Pine Creek Watershed drains the Pine Creek Mineral Belt and the Douglas Subbelt (Part 1, Figure 3.2-3). According to the ore production records, zinc and lead were the most abundant metals produced. The dominant type of ore deposit in the Pine Creek Watershed contains what is referred to as zinc-lead fissure-vein deposits, which are steeply dipping veins that are hosted by and typically cut across argillite of the Prichard Formation (Umpleby and Jones 1923). Most of the fissure-vein deposits occur in fault zones, which are closely spaced faults aligned in roughly the same direction (Umpleby and Jones 1923). For example, the Highland-Surprise vein is associated with the Placer Creek Fault, and the Constitution vein closely parallels the Pine Creek Fault. Other examples of fissure-vein deposits in the watershed occur at the Nabob and Sunset Minerals (also known as the Liberal King [Sunset]) Mines.

The Highland-Surprise vein is somewhat unusual compared to the other vein deposits in the watershed in that a portion of the ore forms as replacement deposits, which is a deposit type more prevalent in the Canyon Creek and Ninemile Creek Watersheds. Replacement deposits occur when ore-bearing fluids alter the host argillite by replacing the quartz and clay minerals with sphalerite and galena.

The principal non-ore minerals in both the vein-type deposits and the replacement deposits are quartz and pyrite. Pyrrhotite is the most common non-ore mineral after quartz and pyrite and is abundant in parts of the Highland-Surprise, Little Pittsburgh, and Nabob Mines. With regard to carbonate minerals, the occurrence and relative abundance of calcite, ankerite, and particularly siderite vary greatly throughout the district. In the Pine Creek Watershed, ankerite is the most common carbonate mineral (Forrester and Nelson 1944). Siderite is either absent from most deposits (e.g., the Douglas and Constitution Mines) or present as a relatively minor constituent as at the Highland-Surprise. Calcite is also either absent from most deposits in the watershed or present as an accessory mineral of the deposits at the Douglas and Constitution.

For both the vein deposits and the replacement deposits, total sulfide content is typically relatively low (perhaps on the order of 3 to 5 percent or less, according to the descriptions of deposits in Umpleby and Jones 1923 and Ransome and Calkins 1908) and the carbonate mineral content (i.e., siderite and calcite) is low to absent.

2.1.6 Mining History

A brief summary of available information on historical mining activities is presented in this section. During the RI/FS process, an extensive list of mines, mills, and other source areas was developed based on a list originally developed by the Bureau of Land Management (BLM 1999). This list is presented in Section 4.1, Nature and Extent, and in Appendix I.

The initial mining boom along Pine Creek began in the early 1910s. From 1884 to 1980, an estimated 50 mines, 10 mills, and 500 patented and unpatented mining claims were in operation in the basin. Most of the mining operations along Pine Creek were concentrated along East Fork Pine Creek, where there were about 45 patented mining claims and approximately 100 unpatented mining claims (Ridolfi 1998).

In the early mining operations in the basin, there were problems with separation of the complex mixture of lead and zinc that was predominant in the area. Pine Creek ores typically required over-grinding to facilitate mineral extraction. This processing technique resulted in a very fine-grained process residue. Selective flotation processes, which were used starting in the 1920s, remedied some of these separation problems, and allowed a greater amount of Pine Creek ore to be profitably mined.

Although some of the ore mined in the Pine Creek Watershed was shipped to other mills for processing, most mine sites built on-site ore processing mills at one time or another. The Surprise (later Highland-Surprise) Mill was the first ore-processing mill to be constructed along the creek. Ore processing consists of the removal of waste material (tailings) from the raw ore to yield a concentrated product for smelting. Early milling operations used gravity concentration to produce concentrates from the raw ore. Gravity separation was an inefficient recovery process, and jig tailings frequently contained as much as 10 percent lead or zinc (Stratus 1999). By the 1920s, most newly constructed mills and some retrofitted existing mills used some type of flotation process for more efficient ore processing. Tailings were typically disposed of directly into or next to the nearest creek.

In 1919, Jacob Pollack won a landmark lawsuit against the Bunker Hill, Hecla, and Gold Hunter Mining Companies. The U.S. District Court in Wallace found the mining companies negligent in their maintenance of the Pine Creek tailings dam, which was reported to have been full by 1914. Pollack was awarded a $3,500 judgment. When the Bunker Hill Mining Company appealed, the Ninth Circuit Court of Appeals in San Francisco made the following statement regarding Bunker Hill's defense on the grounds of miner's preferential water rights:

We find no merit in the contention and no authority to sustain it. It asserts for the miner in Idaho constitutional rights unknown to American constitutional law–the right not only to preference in the use of a stream, but the right to inflict unlimited injury upon property of those who have acquired vested rights as manufacturers or agriculturist (as cited in Casner 1989).

Within this watershed, approximately 50 mines and 10 mills produced approximately 3.2 million tons of ore (Mitchell and Bennett 1983; Mitchell 1996). Of this 3.2 million tons, approximately 102,000 tons of lead, 210,000 tons of zinc, 900 tons of copper, and 140 tons of silver were produced (Mitchell and Bennett 1983). An estimated 2,531,500 tons of tailings were produced from ore processing (SAIC 1993), and an estimated 3,489 tons of tailings were reprocessed (Mitchell 1996). The mines with the largest production, in decreasing order of volumes produced, were the Sidney (Red Cloud), Constitution (Spokane-Idaho), Highland-Surprise, Little Pittsburgh (not shown in figure), Sunset Minerals (also known as the Liberal King [Sunset]), and Nabob (Part 1, Figure 3.2-3).

2.1.6.1 Mines

The mines that operated in the Pine Creek Watershed for which ore production was recorded are listed in Table 2.1-1. This table includes the production years of the mine, estimated volumes of ore and tailings produced as a result of the mining activity, and the segment in which the mine is (or was) located. Only mines with documented ore production are listed. Additionally, some mining operations were carried out at more than one location, occasionally in more than one segment or even more than one watershed. The ore production listed in Table 2.1-1 is the total production for all mining operations.

2.1.6.2 Mills

Table 2.1-2 lists the mills with operations in the Pine Creek Watershed for which there are records. This table includes the operating years of the mill and a summary of ownership, as well as the segment in which the mill is located. Not all mills are listed because records were not available for all mills.

2.1.7 Mine Workings

Underground workings in many mines in this watershed are very extensive and act as collection and distribution systems for groundwater. Individual mine workings in this watershed are typically located within a single, relatively steep ridge. Recharging water infiltrates at the highest levels of a mountain ridge and discharges on the same ridge. This is referred to as a local flow system, characterized by short groundwater flow paths (a flow path is the route by which the water enters and exits the groundwater system) (Toth 1963).

Adits and tunnels in this watershed act as discharge points for groundwater. Typically adit drainage discharges directly to surface water or first infiltrates waste rock piles before discharging to surface water from seeps. Over 70 adits and 11 shafts have been reported in the Pine Creek Watershed, and at least 22 named adits (not shown in a figure) in the watershed are known to discharge mine drainage (CCJM 1995). Fifteen of the 22 adits with discharging mine drainage are located in tributaries to East Fork Pine Creek; 5 adits are located along East Fork Pine Creek; and 2 adits are along Pine Creek (Ridolfi 1999). The discharge of metals from mine workings is discussed further in Section 4, Nature and Extent of Contamination, and in Section 5, Fate and Transport.

2.2 HYDROGEOLOGY

2.2.1 Conceptual Hydrogeologic Model

The Pine Creek Watershed occupies approximately 80 square miles, and West Fork Pine Creek, East Fork Pine Creek, and Pine Creek are the principal drainages of the watershed (Part 1, Figures 1.2-1 and 1.2-2). West Fork Pine Creek flows approximately 5 miles to the confluence with Pine Creek to the north. East Fork Pine Creek flows approximately 7 miles to the confluence with Pine Creek to the north. From the confluence with West Fork Pine Creek, Pine Creek flows about 5 miles in a northerly direction to the point where the East Fork meets Pine Creek. From the confluence with East Fork Pine Creek, Pine Creek flows north about 5 miles to the confluence with the South Fork Coeur d'Alene River (South Fork). The elevation change in the watershed is approximately 3,200 feet, with elevations ranging from 5,400 feet above mean sea level (msl) at the headwaters of East Fork Pine Creek in the St. Joe Mountains, to 2,200 feet above msl at the confluence with the South Fork.

The hydrogeology of the Pine Creek Watershed can be divided into two main groundwater systems: the bedrock aquifer and the shallow alluvial aquifer (CCJM 1995). The conceptual hydrogeologic model for the watershed assumes that a single unconfined aquifer is present in the shallow alluvial sediments, and these sediments are the principal hydrostratigraphic unit in the watershed. The shallow alluvial sediments consist of natural materials as well as mine tailings and waste rock.

Although relatively little hydrogeologic data is available for the watershed as a whole, a study of the largest millsites located along East Fork Pine Creek and Pine Creek confirmed the presence of an unconfined alluvial aquifer overlying bedrock in the vicinity of these millsites (CCJM 1995). In general, the alluvium increases in thickness from the headwaters of East Fork and West Fork Pine Creek toward their confluence with the South Fork.

The bedrock aquifer within the Pine Creek Watershed consists of argillites and lesser quartzites of the Precambrian formations of the Belt Supergroup, including (principally) the Prichard Formation, and a relatively minor amount of Burke Formation at the headwaters of East Fork Pine Creek and West Fork Pine Creek (Part 1, Figure 3.2-1).

In general, the bedrock has very low permeability. Secondary features such as fractures, faults, or mine workings may increase the permeability substantially. Mine workings that may influence recharge to the bedrock aquifer were discussed in Section 2.1.7, Mine Workings.

The groundwater system of unconsolidated sediments overlying less permeable rocks occurs in elongate, V-shaped troughs along the entire lengths of East Fork Pine Creek and West Fork Pine Creek; and along the reach of Pine Creek from the confluence with the East Fork and West Fork to an area about one mile above the town of Pinehurst, near the confluence with the South Fork (Part 1, Figure 3.2-1). Pine Creek is located within a relatively wide, U-shaped valley along the one mile reach between Pinehurst and the South Fork.

2.2.1.2 Groundwater Level Fluctuations

As observed in wells in the Canyon Creek, Moon Creek, and Ninemile Creek Watersheds, it is assumed that groundwater levels fluctuate seasonally in the Pine Creek Watershed. Groundwater levels are generally highest in the late spring and lowest during winter and early spring when precipitation rates are lowest and snowmelt is not occurring.

2.2.2 Aquifer Parameters

Aquifer parameters are not available from the Pine Creek Watershed for the presumed single unconfined aquifer in unconsolidated sediments overlying bedrock. However, based on reported lithologic similarities between the presumed single unconfined aquifer in the Pine Creek Watershed and the upper aquifer of the Smelterville Flats-Bunker Hill groundwater system, it is reasonable to expect that aquifer parameters presented in Table 2.2-1 are similar to the presumed single unconfined aquifer of the Pine Creek Watershed. The range of horizontal hydraulic conductivities presented in Table 2.2-1 are typical of clean sand and gravels (Freeze and Cherry 1979).

2.2.3 Flow Rates and Directions

Based on similar watersheds (e.g., Canyon Creek, Moon Creek, and Ninemile Creek), it can be assumed that the general groundwater flow direction in the Pine Creek Watershed parallels the flow of Pine Creek surface water and its tributaries. Further from the axis of the creek, there may be a component of flow toward the creek. Based on water level data recorded in Canyon Creek, it can be assumed that there are localized areas in Pine Creek where the flow direction is downstream and toward the creek (gaining reaches) and some areas where the flow direction is downstream and away from the creek (losing reaches).

2.2.4 Surface Water/Groundwater Interaction

Based on groundwater information collected from millsites along Pine Creek and East Fork Pine Creek, it can be assumed that shallow alluvial deposits along Pine Creek and its tributaries serve as aquifers (CCJM 1995). Based on groundwater information collected from Canyon Creek, it is also assumed that the aquifer and adjacent creeks are hydraulically connected, and they are capable of taking from or adding to flow in the creek. The interaction of the surface water in Pine Creek and groundwater in the shallow alluvial aquifers has the potential to create gaining or losing reaches, based on data collected in Canyon Creek. During the spring snowmelt and resulting high creek levels, the gaining reaches of the stream may temporarily experience reversals in the surface water/groundwater hydraulic gradient (i.e., become losing reaches).

2.2.5 Water Quality and Water Chemistry

Water quality parameters (temperature, pH, specific conductance, salinity, turbidity, and oxidation-reduction [redox] potential) and water chemistry data (e.g., chloride, sulfates, and sulfides) are discussed in Section 4, Nature and Extent of Contamination, and in Section 5, Fate and Transport.

2.2.6 Groundwater Use

Domestic water for Pinehurst, the largest town in the watershed, is recovered from a well network located in Pinehurst. Water is drawn from the alluvial material deposited in the valley bottom of Pine Creek (CCJM 1995).

Use of groundwater supplies for domestic, municipal, and industrial applications (as it relates to human consumption) is discussed in the baseline human health risk assessment.

2.3 SURFACE WATER HYDROLOGY

The following sections describe the surface water hydrology of the Pine Creek Watershed, a tributary to the South Fork Coeur d'Alene River. The Pine Creek Watershed has a drainage area of approximately 79.6 square miles, with approximately 10.22 miles of mapped channel length in the main stem and West Fork.

2.3.1 Available Information

The available hydrologic information for Pine Creek includes United States Geological Survey (USGS) stream flow data for Pine Creek for water year 1999, climatological data for Kellogg, ID, and instantaneous discharge data from a variety of consultants obtained between 1991 and 1999. In addition, historic USGS discharge data is available for Placer Creek, of similar size and near Canyon Creek.

The United States Geological Survey (USGS) began reporting stream flow discharge data from Station Number 12413445, Pine Creek below Amy Gulch near Pinehurst, ID, on October 1, 1998 (USGS 2000). This station is located near the downstream end of PineCrkSeg04 and has a drainage area of approximately 77 square miles, 97 percent of the total Pine Creek Watershed. This station records water stage at 15-minute intervals. Discharge is calculated from the stage data based on a rating curve developed for the specific gage. The rating curve is developed through time by measuring discharge at known stages to relate stage to discharge. Once a rating curve is developed, a discharge can be calculated by comparing a known stage to the rating curve. One complete year of discharge data, water year 1999, is available at this time for Pine Creek at Amy Gulch. Water year 1999 ran from October 1, 1998 to September 30, 1999. Precipitation data from the Western Regional Climate Center (WRCC) station at Kellogg were collected for the same period (WRCC 2000). This precipitation gage is the nearest gage to Pine Creek. The mean daily discharge hydrograph and precipitation data are presented in Figure 2.3.1-1. The maximum mean daily discharge recorded during water year 1999 was 1,370 cubic feet per second (cfs) with an instantaneous peak of 1,560 cfs on May 25, 1999.

The USGS has several gages near Pine Creek with historic streamflow data; most notably USGS station number 12413140, Placer Creek at Wallace, ID. The Placer Creek gage has a drainage area of 14.9 square miles and a period of record from November 1967 to September 1995, October 1996 to September 1997, and water year 1999 (USGS 2000). This data can be used to extrapolate estimates of historic hydrographs within Pine Creek.

Stream discharge measurements were taken in association with water quality sampling events completed by McCulley, Frick & Gilman Inc. (MFG), URS, Idaho Division of Environmental Quality (IDEQ), and USGS. These measurements have occurred since 1991. These data can be used to evaluate the adequacy of the historic hydrographs developed from the Placer Creek data. These data are summarized in Table 2.3.1-1.

In addition to the USGS hydrologic information, the U.S. Department of Housing and Urban Development, Federal Insurance Administration completed a flood insurance study for Shoshone County, Idaho (FIA 1979). Peak discharges were computed for 10-year (3,885 cfs), 50-year (8,525 cfs), 100-year (11,380 cfs) and 500-year (19,510 cfs) events for Pine Creek at the mouth.

2.3.2 Hydrologic Description

The hydrology of the Pine Creek Watershed based on water year 1999 stream discharge data, precipitation data, and estimates of historical discharge developed from USGS discharge data from other watersheds is presented in this section.

2.3.2.1 Historical Description

Continuous discharge data for Pine Creek is not available so an estimate of mean daily discharge at the mouth of Pine Creek was developed by extrapolating from historic data from Placer Creek. Mean daily discharge for Placer Creek was scaled by the ratio of drainage area of Pine Creek to Placer Creek at the Pine Creek gage, to produce an estimate of mean daily discharge for Pine Creek for the period of record of Placer Creek. This hydrograph is presented as Figure 2.3.2-1.

To assess the adequacy of this approach, the difference between estimate and measured discharge at the Pine Creek gage was calculated. The difference and the estimated and measured hydrographs are presented in Figure 2.3.2-2. Agreement between the estimated discharge and measured discharge is relatively good; however, 40 to 60 percent discrepancies should be expected as indicated by the variation in values indicated in Figure 2.3.2-2. The estimated discharge in Pine Creek underestimates flows for events occurring in the winter and spring while overestimating discharges in the summer. This is likely the result of the different elevations of the two watersheds. The Pine Creek Watershed is situated at lower elevations than the Placer Creek Watershed. Therefore, precipitation in the Pine Creek Watershed more likely occurs as rain than in the Placer Creek Watershed during the winter and spring months. Rain quickly runs off the surface while snow is stored until melted, later in the season.

From Figure 2.3.2-1, the maximum mean daily discharge is estimated at 4,650 cfs and occurred on January 15, 1974. Base flow is estimated to be 20 to 30 cfs. Average annual discharge is estimated at approximately 190 cfs. The maximum discharge recorded at the Placer Creek gage is outside the period of record; however, the USGS has estimated this discharge at 2,200 cfs on February 9, 1996. Applying the relationship presented above results in an estimate of maximum discharge for Pine Creek of 11,600 cfs. The discharge measurement presented in Table 2.3.1-1 are consistent with the extrapolated estimates of discharge for shown in Figure 2.3.2-1.

2.3.2.2 Flood Frequency

Table 2.3.2-1 presents the estimated discharges for specified flood frequency recurrence intervals for Pine Creek. Because historic discharge data is not available for Pine Creek and the estimates of mean daily discharge are already subject to uncertainty, additional manipulation to obtain flood frequency estimates was not completed. Instead, flood frequency developed in the FIS is presented. The bankful discharge, the approximately 1.5-year event, is estimated to be approximately 1,000 cfs.

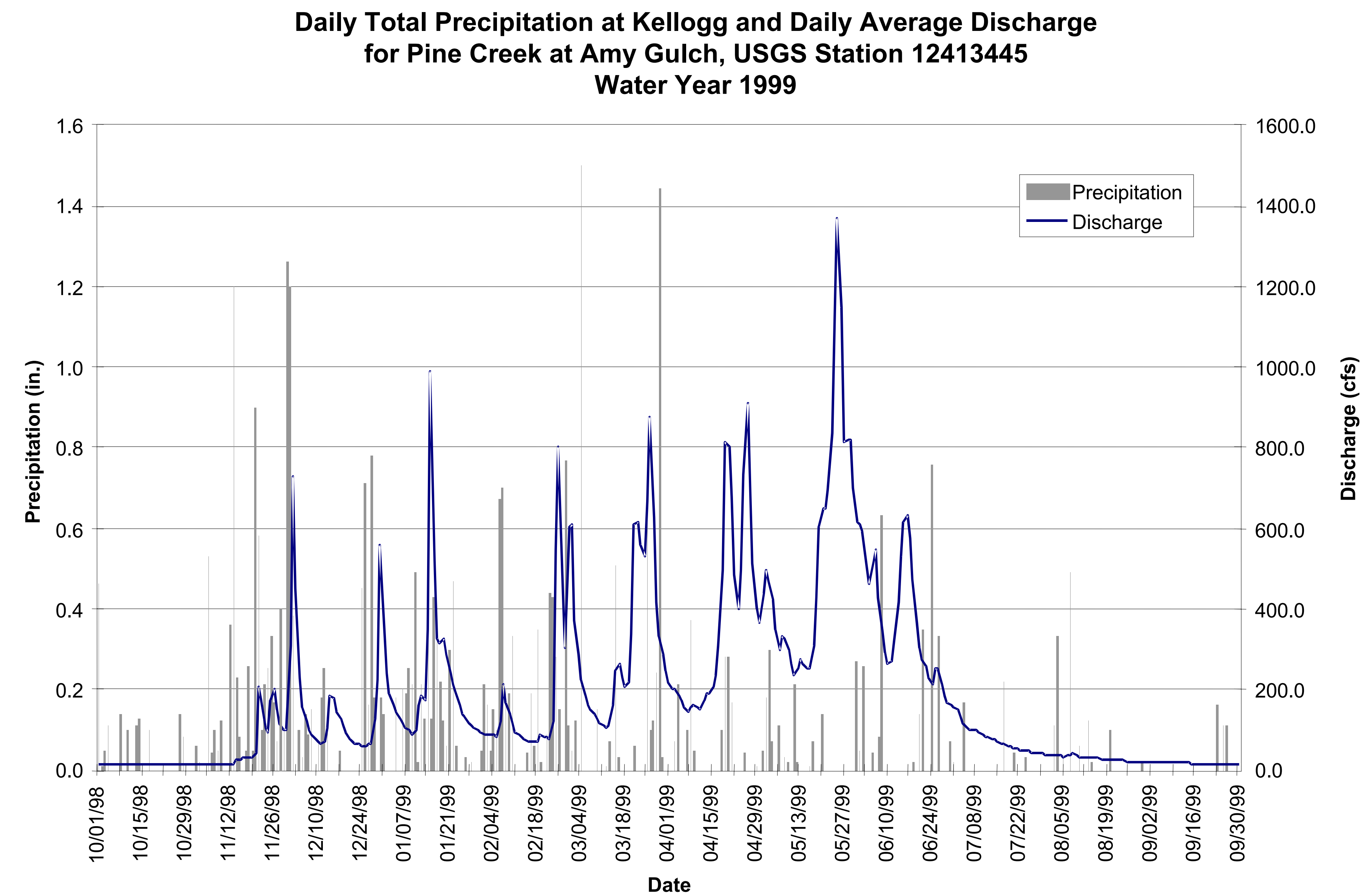
2.3.2.3 Water Year 1999

Total annual average precipitation at the WRCC Kellogg Station for the 95-year period of record is 30.8 inches, while for water year 1999 the total precipitation was 37.8 inches (WRCC 2000). Total annual average snowfall for the WRCC station is 54.3 inches, while for water year 1999 the total snowfall was 35.5. While these comparisons do not address monthly variations in precipitation, they do indicate that the water budget for water year 1999 was somewhat typical with above average total precipitation and below average snowfall.

Table 2.3.2-2 summarizes the mean monthly flows for Pine Creek, mean monthly precipitation at the WRCC Kellogg Station (rain and snow water content), and total snowfall at the WRCC station at Kellogg for water year 1999. Table 2.3.2-2 and Figure 2.3.1-1 indicate the majority of precipitation occurred from October to March, 78 percent of the total annual precipitation at the Kellogg gage. Much of this precipitation was in the form of snow and did not run off into the stream channels immediately. However, increased discharge at the Pine Creek gage, above the average annual discharge of 190 cfs, occurred seven times during the winter and spring months, November 21, November 26, December 1 to December 4, December 29 to January 2, January 14 to January 23, February 7, and February 24 to March 4 for a total of 26 days. In contrast, during the spring and summer months, discharge at the Pine Creek gage remained above the average annual discharge from March 15 to June 27 with the exception of April 4 to April 13, a total of 95 days. This type of drainage pattern is similar to historical flows in surrounding watersheds where much of the annual discharge occurs during the spring and summer with limited periods in the fall and winter with above average annual discharge, Figures 2.3.2-1 and 2.3.2-2.

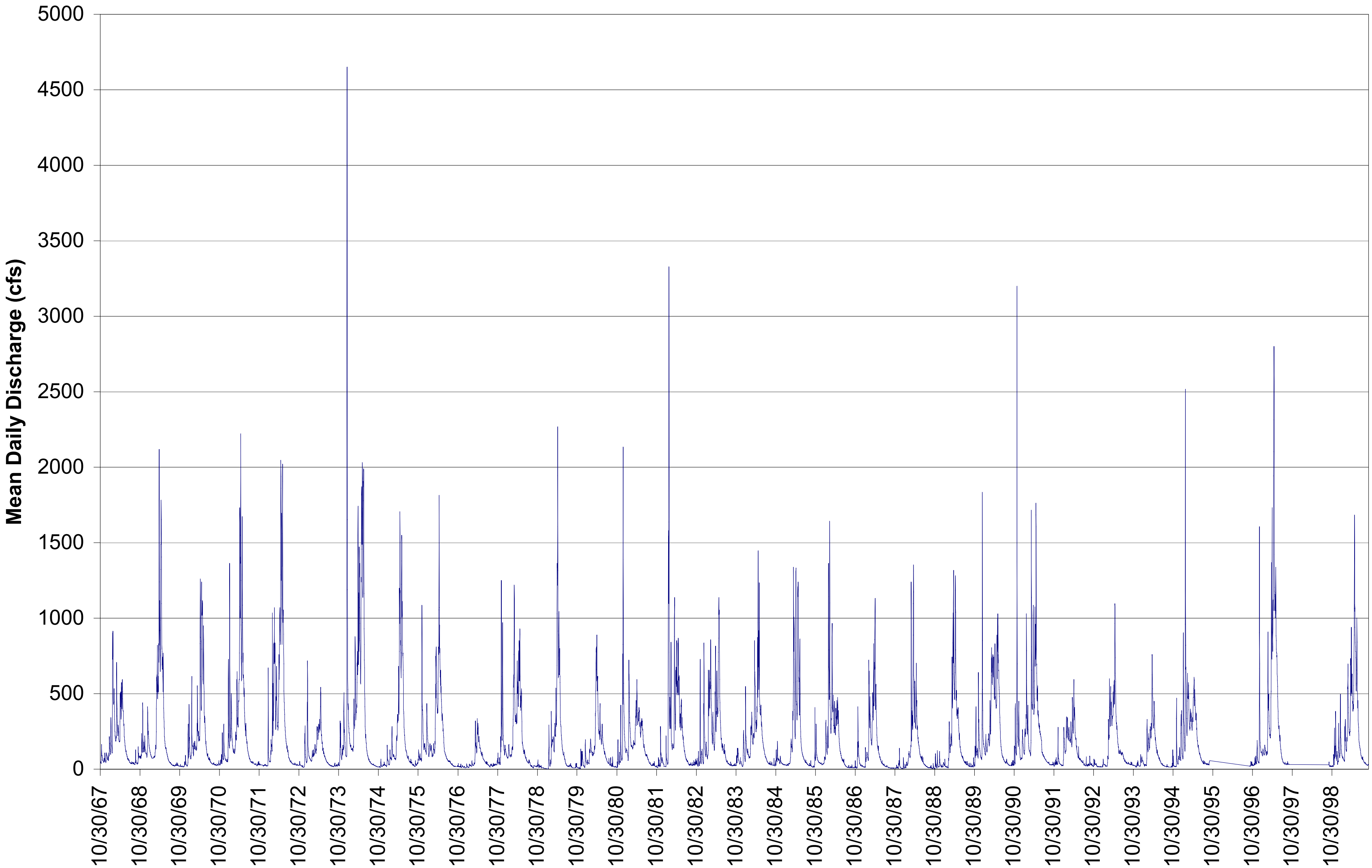
The increase in discharge during the spring and summer is attributed to increased runoff caused by snowmelt in the upstream watersheds. Maximum daily temperature and mean daily discharge for water year 1999 for the Pine Creek are presented in Figure 2.3.2-3. Increased temperatures over these periods melted much of the snow in the upper basin. Rain on snow also may have contributed to these increased discharges as indicated in Figure 2.3.1-1 where precipitation events also occurred during periods of increased temperature.

Based on the existing data, it is expected that water year 1999 was typical from a total snowfall and total water budget perspective in the Pine Creek Watershed. Runoff from spring snowmelt dominates the surface water hydrology. Variations in snowfall, temperature, and rainfall from year to year will influence the peak discharges.



EPA REGION 10	027-RI-CO-102Q Coeur d'Alene Basin RI/FS RI REPORT	Doc Control: 4162500.6615.05.a Generation: 1 Pine Creek Series 07/13/01	Figure 2.3.1-1

Pine Creek Estimated Discharge From Placer Creek Data



EPA REGION 10

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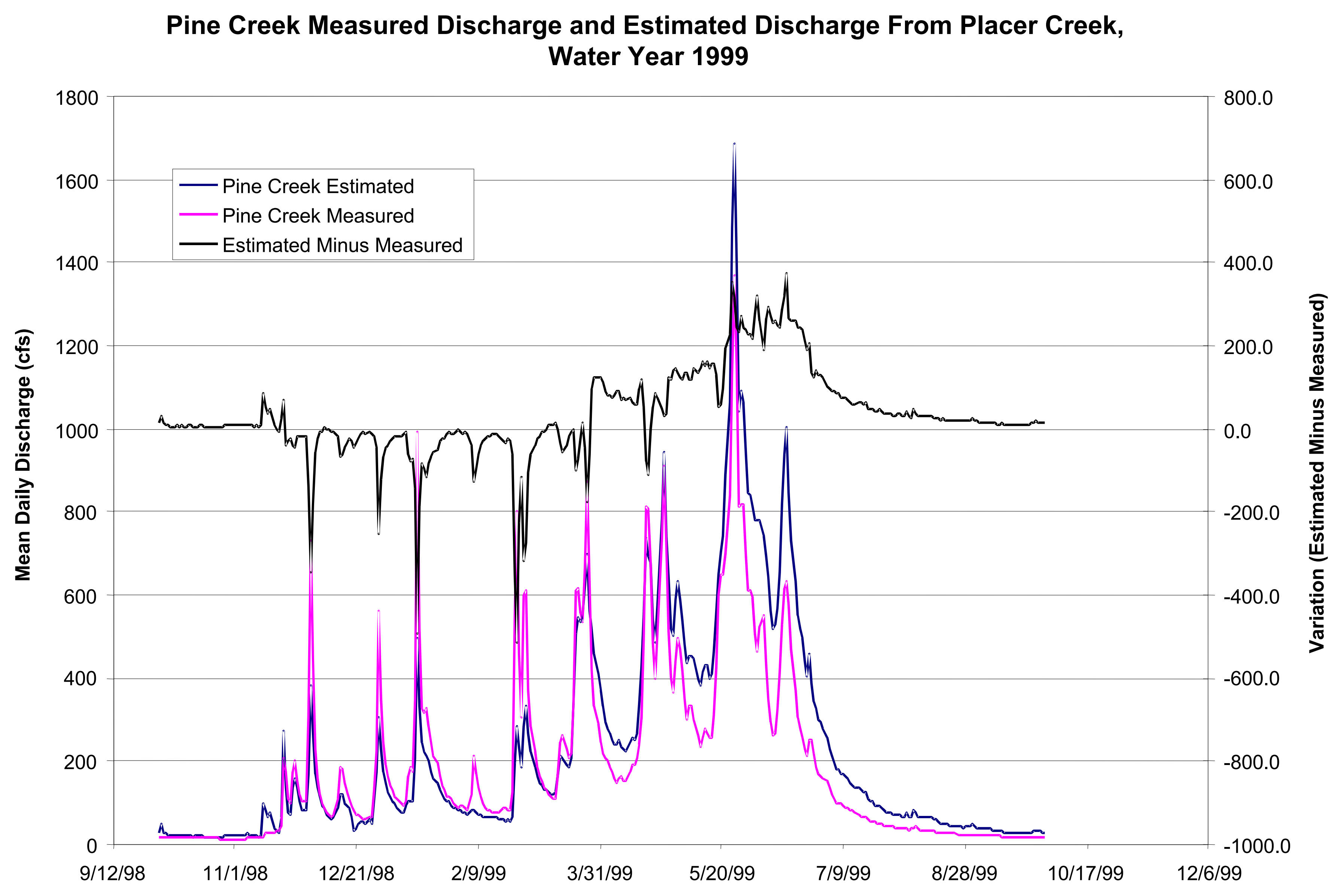
Coeur d'Alene Basin RI/FS
RI REPORT

Doc Control: 4162500.6615.05.a
Generation: 1

Pine Creek Series
07/13/01

Figure 2.3.2-1



EPA REGION 10

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Coeur d'Alene Basin RI/FS
RI REPORT

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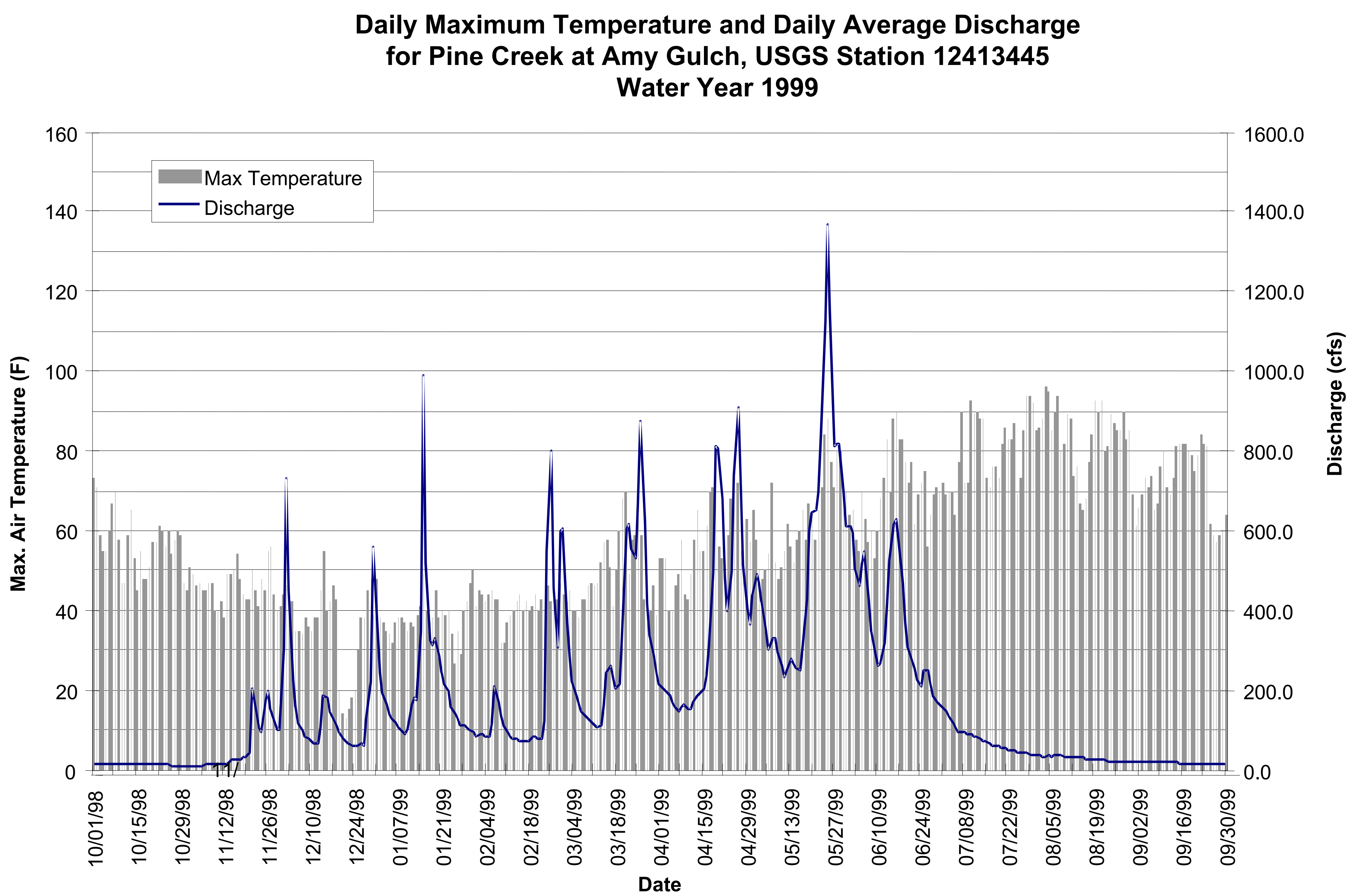
Generation: 1

Pine Creek Series
07/13/01

Figure 2.3.2-2



EPA REGION 10

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Coeur d'Alene Basin RI/FS
RI REPORT

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Generation: 1

Pine Creek Series
07/13/01

Figure 2.3.2-3

Table 2.1-1
Mines in Pine Creek Watershed With Recorded Production

Segment	Production Years	Ore (tons)	Mill	Tailings (tons)	Comments
Amy-Matchless Mine					
PineCrkSeg03	1912 - 1956	4,569	Amy-Matchless	4,359	The Amy-Matchless Mine was located by Gus Smith in 1887. By 1911, the mine was being operated by the Culver Mining Company, and in 1912 the first car of ore was shipped from the mine. Later that year, the mine was taken over by the Amy-Matchless Mining & Milling Company. In 1929, the Amy-Matchless Mining & Milling Company and Olympic Mines combined to form the Pine Creek Consolidated Mining Company. In 1931, the company's property was sold under court order. Little else was done at the mine until it was acquired by the Lynch-Pine Creek Mining Company in 1942. In 1946, the Lynch-Pine Creek Mining Company changed its name to the Amy Silver-Lead Company. During the 1940s, ores from the Nabob and other mines were being processed at the mill, but the mine saw little activity. In 1947, Nancy Lee Mines, Inc., was given a perpetual working agreement on the mine. Some development and rehabilitation work was done during this time. In 1954, New Era Mines acquired a perpetual working agreement on the property and the mine was later explored by Cominco American in the early 1980s (Mitchell 1996).
Bobby Anderson (Signal) Mine					
PineCrkSeg01	1927 - 1951	523		432	The Bobby Anderson Mining Co. was incorporated in 1906. In 1939, the name was changed to the Signal Mining Co. In 1944, small shipments of ore were made by Benjamin J. Harmon, who was operating the mine under a lease agreement. (SAIC 1993).
Coeur d'Alene Antimony (Fourth of July) Mine					
PineCrkSeg03	1885 - 1919	1,000		NA	The Coeur d'Alene Antimony Mine was reopened by new owners in 1915 in response to demand from ore buyers. The mine operated until 1919, when unfavorable market conditions forced its closure. The operation history of the mine prior to 1915 is unclear (Quivik 1999).

Table 2.1-1 (Continued)
Mines in Pine Creek Watershed With Recorded Production

Segment	Production Years	Ore (tons)	Mill	Tailings (tons)	Comments
Constitution (Spokane-Idaho)					
PineCrkSeg01	1915 - 1968	667,326	Constitution, Amy-Matchless	538,249	The first claims of the Constitution Mine were staked in 1901 by Thomas Gilbert, Henry Gilbert, Thomas Thwaite, and George Green. Thomas Gilbert was the officer of the newly organized Constitution Mining & Milling Company by the following year. In 1915, the company secured several investors and began a "vigorous" development campaign. The company shipped at least three car loads of rich ore within the same year. The mine continued to operate until 1919, when it was closed because of low post-war prices for metals and shipping difficulties due to the lack of rail transportation on Pine Creek. The mine was reopened in 1923 and ore began to be shipped again in 1924. In 1925, the Constitution was the largest mine in the Pine Creek Watershed. Mine operations continued through the 1920s, and then production was suspended in June 1930 because of low metals prices. The property remained idle and was then sold in 1936 to satisfy a judgement in favor of the miners employed at the property. The Spokane-Idaho Mining Company was organized and began operating at the mine in 1940. The Spokane-Idaho Mining Company operated the mine through March 1953, and it was operated by lessees until its closure in June 1955. The Constitution Mining Company was organized in 1967, and records indicate ore production from the mine in 1968. The property was later explored by Cominco in the early 1980s (Mitchell 1996).
Denver					
PineCrkSeg01	1916 - 1944	13,000	Bunker Hill Complex, Sullivan, Sidney	8,220	The Nabob Mining Co. had acquired and was actively developing the Denver Mine by July 1916. By 1944 the mine was being controlled by the Denver Mining Co. (SAIC 1993)
Douglas					

Table 2.1-1 (Continued)
Mines in Pine Creek Watershed With Recorded Production

Segment	Production Years	Ore (tons)	Mill	Tailings (tons)	Comments
PineCrkSeg01	1916 - 1972	167,162	Douglas, Great Falls, Constitution	138,440	The Douglas Mine was operated by the Douglas Mining Company and by several others under various agreements beginning about 1911 and through 1929. During this time, ore from the mine was shipped to a variety of off-site mills for concentration. Between 1943 and 1955, the mine was operated intermittently by several companies, including the Small Leasing Company, Douglas Leasing Company, and Spokane-Idaho Mining Company (Quivik 1999).
Highland-Surprise					
PineCrkSeg01	1904 - 1971	518,706	Highland-Surprise	332,847	The Surprise Prospect was located in April 1900 by M.J. Sinclair, and the Highland Chief was located later the same year by Henry Gilbert, Sanford Lamb, and W. Pipes. Each mine operated independently until 1912, when the Highland-Surprise Consolidated Mining Company was organized and the two mines were merged. In 1916, the Highland-Surprise Mine was the largest producer of zinc-lead ore in the Pine Creek district, but as was typical of mines in the Pine Creek Watershed, production was hampered by poor transportation. The mine was idle from 1918 through 1921 and was operated by lessees for the next 3 years. The Highland-Surprise Consolidated Mining Company resumed operations at the
Highland-Surprise (Continued)					
PineCrkSeg01	1904 - 1971	518,706	Highland-Surprise	332,847	mine in 1925 and continued operations through 1928. The mine was then shut down until 1940. The company discontinued all underground operations at the mine in 1955. Various lessees performed intermittent work at the mine through 1969 (Mitchell 1996)
Hilarity					
PineCrkSeg01	1926 - 1952	3,330		3,103	The Hilarity Mine is located on Denver Creek, above its confluence with East Fork Pine Creek. The early history of the mine is unclear. Both Gus Smith and J. Ran Sanborn have been credited with locating the mine about 1886. The Hilarity Mining Company was incorporated and acquired control of the mine in 1899. By 1913, two tunnels on opposite

Table 2.1-1 (Continued)
Mines in Pine Creek Watershed With Recorded Production

Segment	Production Years	Ore (tons)	Mill	Tailings (tons)	Comments
					sides of Denver Creek had been developed. In 1917, the Hilarity Mining Company and the Pine Creek Mining & Milling Company were consolidated. The newly consolidated company retained the name Pine Creek Mining & Milling Company. Development work on the mine continued and then in July 1922, the name of the company was changed to the Hilarity Lead-Silver Mining Company. A fire destroyed the surface plant of the mine in 1924. By 1926, total development at the mine consisted of 2,000 feet of workings. Several small shipments of ore to the Sweeny Mill yielded satisfactory results that year. Little work was done at the mine for the next several years, and the Hilarity Lead-Silver Mining Company forfeited its charter in November 1930. The New Hilarity Mining Company acquired control of the property in 1945. By 1949, the Signal Mining Company had acquired a lease on the property. Signal was involved with a Defense Minerals Exploration Program (DMEA) contract on the property in the early 1950s. The ore located by this project was of marginal grade. Only assessment work has been conducted at the property since that time (Mitchell 1996).
Liberal King (Sunset)					
PineCrkSeg03	1937 - 1963	256,437	Liberal King (Sunset)	220,006	The Liberal King Mine was located by Sanford Lamb and Magnus Cheyne before 1905. Sanford Lamb or his heirs apparently retained at least partial ownership of the property until 1928, but historical records indicate several property owners before the property was acquired by the Liberal King Mining Company (Mitchell 1996). The Liberal King Mining Company was incorporated on June 12, 1928, and began developing the mine the same year (Quivik 1999). Development work and some ore production continued through February 1943, when the mine was closed because of a lack of funding for further development. In July 1943, Sunset Minerals, Inc., acquired a lease with the option to buy the property. Sunset Minerals acquired title to the property and equipment in 1948. Sunset Minerals continued to operate the mine directly or through lessees until 1957. Cominco American,

Table 2.1-1 (Continued)
Mines in Pine Creek Watershed With Recorded Production

Segment	Production Years	Ore (tons)	Mill	Tailings (tons)	Comments
					Inc., rehabilitated some of the workings and conducted an exploration program from 1981 to 1985 (Mitchell 1996).
Little Pittsburgh					
PineCrkSeg01	1916 - 1955	320,674	Little Pittsburgh, Great Falls, Nabob	275,624	The Little Pittsburgh Mine was located about 1897 by George Augustus Smith. The Colonial Mining & Milling Company began operation of the Little Pittsburgh Mine in 1915. The mine shipped its first car of high-grade zinc ore in 1916. The mine was then closed around the end of World War I and did not operate for most of the next decade. In 1929, the Pine Creek Lead-Zinc Company was organized and assumed control of the mine. The newly organized company began a vigorous development of the mine and constructed a new mill at the site. However, little production was accomplished through the 1930s because of low metals prices. The Lessee Mining Company leased the mine in 1941 and later the Denver Development Company operated the mine through a lease agreement from 1941 to
Little Pittsburgh (Continued)					
PineCrkSeg01	1916 - 1955	320,674	Little Pittsburgh, Great Falls, Nabob	275,624	1951. Mascot Mines, Inc., then operated the mine from 1952 to 1955. U.S. Antimony Corp. and Intermountain Mineral Engineers, Inc., leased the property from 1975 to 1980. Ore produced from this project was shipped to the 250-tons-per-day Nabob Millsite. Cominco American, Inc., conducted an exploration project at the mine from 1982 to 1985. Intermountain Mineral Engineers, Inc., also mined some ore in 1985 (Mitchell 1996).
Lookout Mountain					
PineCrkSeg03	1922 - 1952	1,595	Charles Dickens, Liberal King (Sunset), Amy-	1,149	Ore was discovered in the No. 2 tunnel of the Lookout Mountain Mine about 1921. By 1922, a train had been constructed and the mine began shipping ore. In 1944, the mine was under lease and bond by the Lookout Leasing Co. In 1947, a cross cut was driven to tie in the Liberal King Mine, thus allowing exploration from the bottom of the Liberal King shaft. (SAIC 1993)

Table 2.1-1 (Continued)
Mines in Pine Creek Watershed With Recorded Production

Segment	Production Years	Ore (tons)	Mill	Tailings (tons)	Comments
			Matchless		
Nabob					
PineCrkSeg01	1907 - 1977	134,069	Nabob, Amy-Matchless	111,759	The Nabob Claim was located by George E. Stone in April 1890. The first recorded production for the mine dates back to 1907, at which time the mine was operated by the Nabob Mining Company. Later the mine was operated by the Nabob Consolidated Mining Company. In 1923, the Nabob Silver-Lead Company took over the property and assumed the liabilities of the Nabob Consolidated Mining Company. Operations at the mine were interrupted in 1926 and 1927 by legal proceedings against the board of directors. After settlement of the legal proceedings, the mine remained closed because of low metals prices. Little work was done at the mine until 1943, when the Lynch-Pine Creek Mining Company obtained a lease on the property. This lease was relinquished in June 1945, and the Nabob
Nabob (Continued)					
PineCrkSeg01	1907 - 1977	134,069	Nabob, Amy-Matchless	111,759	Silver-Lead Company continued work at the mine. The mine was operated intermittently, closing several times because of low metals prices. The upper workings of the mine were also being worked by lessees at this time. In 1959, the Sidney Mining Company obtained a 5-year lease on the property. This lease agreement was terminated the following year. The mine continued to be intermittently operated by various lessees through the 1960s. The mine was involved in a joint-venture exploration program with U.S. Antimony Corp. and Intermountain Mineral Engineers, Inc., from 1975 to 1981. Cominco American, Inc., then leased the property from 1982 to 1985 (Mitchell 1996).
Nevada-Stewart					
PineCrkSeg01	1900 - 1917	377	Highland-Surprise	NA	Small producer

Table 2.1-1 (Continued)
Mines in Pine Creek Watershed With Recorded Production

Segment	Production Years	Ore (tons)	Mill	Tailings (tons)	Comments
Sidney (Red Cloud)					
PineCrkSeg01	1921 - 1967	1,071,197	Sidney, Galena, Sweeny, Star/Morning, Bunker Hill Complex	816,733 816,733	The early history of the Sidney Mine is unclear. Various sources provide several accounts of the first locators, who established the claim sometime in the 1890s. Little work was done other than the required annual assessment, until the Sidney Mining Company was established in 1910. L.W. Gray, who is reported by at least one source as being a locator of the mine, was president of the newly established company. Some development work continued at the mine in the mid-1910s, but the mine was apparently inactive from 1917 through 1919. The mine was operated by lessees during the early 1920s. The Sidney Leasing Company, organized in 1925, acquired a 10-year lease on several of the Sidney Claims during the same year. Shipment of ore from the mine was soon facilitated by the
Sidney (Red Cloud) (Continued)					
PineCrkSeg01	1921 - 1967	1,071,197	Sidney, Galena, Sweeny, Star/Morning, Bunker Hill Complex	816,733 816,733	construction of a 3.5-mile aerial tramway. Sidney was the third largest producer of zinc and the tenth largest producer of lead in Idaho in 1928. The Sidney Leasing Company was able to operate the mine at a substantial profit even during the period of low metals prices in the late 1920s. Production was halted at the mine in 1930 but development continued. The Sidney Leasing Company continued intermittent production at the mine throughout the 1930s. In 1942, the Sidney Mining Company resumed operation of the mine. Production at the mine was aided by the construction of a 50-ton mill that began operating in 1944. The Sidney Mining Company continued production at the mine until the early 1960s. The mine was operated or explored by several lessees through the 1980s (Mitchell 1996).

Notes:
Blank cells indicate that there was most likely no mill located on site, and ores were probably shipped elsewhere for milling. No records were found identifying the mill to which the ores were shipped. Estimated tailings produced by each mine were not necessarily disposed of within the reach where the ores were mined.
Source: Stratus 1999 (unless other noted).

Table 2.1-2
Mills With Documented Operations in Pine Creek Watershed

Mill	Segment	Operating Years	Ownership	Comments
Amy-Matchless Mill	PineCrkSeg03	1923 - 1928 1935 - 1951	Amy-Matchless Mining & Milling Company, Lookout Mountain Mining & Milling Company,[a] Lynch-Pine Creek Mining Company	Prior to 1923, ores from the Amy-Matchless Mine were shipped off site for milling or were hand jigged on site. In 1923, the Amy-Matchless Mining & Milling Company built a concentration mill on the east side of Pine Creek. The mill was operated by the Lookout Mountain Mining & Milling Company in 1928 and was then closed until it was remodeled in 1935. The mill saw little activity after the remodeling until 1943, when it was used to treat ore from the Little Pittsburgh, which lost its mill to fire. The Lynch-Pine Creek Mining Company purchased the mine and mill in 1944 and used the mill to treat ore from the Nabob Mine. The mill was abandoned by 1951, and a cleanup was conducted in 1956 (Quivik 1999). The mill was destroyed by fire in July 1994 (Mitchell 1996).
Coeur d'Alene Antimony Mill	PineCrkSeg03	1915 - 1919	Coeur d'Alene Antimony Mining Company	The Coeur d'Alene Antimony Mining Company completed the construction of a new mill in 1915. A flotation unit was installed at the mill in 1918 but unfavorable market prices forced closure of the operation in 1919 (Quivik 1999).
Constitution Mill	PineCrkSeg01	1917 - 1955	Constitution Mining & Milling, Spokane-Idaho Mining Company, undetermined lessees	The Constitution Mining & Milling Company built a 100-ton gravity flotation mill on East Fork Pine Creek in 1917. The mill proved ineffective in separating the complex mixture of lead and zinc that was predominant in the Pine Creek Watershed. In 1924, the company installed new separating process equipment. Production at the mine was suspended and the mill closed about 1930. The mill was reopened in 1941 by the Spokane-Idaho Mining Company. In 1944, the company changed its milling practice to produce high-grade lead concentrate as well as zinc-lead concentrate. Between 1953 and 1955, ore was treated at the mill by lessees (Quivik 1999).

Table 2.1-2 (Continued)
Mills With Documented Operations in Pine Creek Watershed

Mill	Segment	Operating Years	Ownership	Comments
Douglas Mill	PineCrkSeg01	1943 - 1955	Small Leasing Company, Douglas Leasing Company, Spokane-Idaho Mining Company	Prior to 1943, ore from the Douglas Mine was shipped off site to a variety of mills for separation. In 1943, the Small Leasing Company built a 100-ton flotation plant at the Douglas Mine. The Douglas Leasing Company operated the mill in 1948; however, it is unclear whether the mill operated after that time, as there is some evidence that ore from the Douglas Mine was milled at the Constitution Mill. A cleanup of the mill was completed in 1956 (Quivik 1999).
Highland-Surprise Mill	PineCrkSeg01	1907 - 1927 1941 - 1955	Highland-Surprise Mining Company	The Surprise Mill began operation in October 1907. The mill operated intermittently until the company's merger with the owners of the Highland Chief Property in 1912. It was at this time that the mine and mill were renamed Highland-Surprise. The mill was enlarged in 1916 and flotation cells were installed to improve separation efficiency. The mill continued to operate until about 1917. In 1925, the mill was completely remodeled to treat ore by differential flotation. The mill then operated sporadically until its closure in 1927. A new 100-ton flotation mill was constructed in 1941. In 1948, mill capacity was increased to 300 tons per day. The mill was closed in 1955 and a cleanup was conducted in 1956. The mill was scrapped in 1962 (Quivik 1999).
Liberal King Mill	PineCrkSeg03	1944 - 1957	Sunset Minerals, Inc., undetermined lessees.	Although the Liberal King Mining Company was incorporated on June 12, 1928, a mill was not constructed on the property until 1944. Sunset Minerals, Inc., obtained a lease on the property and constructed a flotation plant around the same time. Sunset later purchased the property and operated the mill through 1956. Lessees operated the property through 1957, and a cleanup of the mill was completed in 1962 (Quivik 1999).

Table 2.1-2 (Continued)
Mills With Documented Operations in Pine Creek Watershed

Mill	Segment	Operating Years	Ownership	Comments
Little Pittsburg Mill	PineCrkSeg01	1930 - 1943 1943 - 1952	Pine Creek Lead-Zinc Company, Denver Development Company,[a] Mascot Mines, Inc.[a]	The newly organized Colonial Mining & Milling Company began construction of a 250-ton concentrator mill on Denver Creek in 1915. There is no record of the mill's completion or operation. In 1929, the Pine Creek Lead-Zinc Company took possession of the property and began construction of a 250-ton fine-grinding flotation concentrator. This mill was completed in 1930 but did not treat any ore for the next decade. The property was leased to the Denver Development Company in 1942, and the mill was used to treat ore until 1943, when it was destroyed by fire. A new 100-ton flotation mill was built in its place and used to treat ore until Denver's lease ended in 1949. Mascot Mines, Inc., operated the mill during 1952 (Quivik 1999).
Nabob Mill	PineCrkSeg01	1919 - 1924 1946 - 1957	Nabob Consolidated Mining Company, Nabob Silver-Lead Company	The Nabob Consolidated Mining Company planned the construction of a 150-ton mill in 1918, after the discovery of a good grade of lead-zinc ore. The mill was built on the lower stretches of Nabob Creek above the confluence with Pine Creek. The mill operated intermittently through the early 1920s, until it was destroyed by fire in 1924. Although the mine continued to be developed after this time, ore was shipped off site for processing. In 1945, the Nabob Silver-Lead Company began construction of a new 250-ton flotation mill, which operated through 1957 and was then closed because of low metals prices. The mill was rehabilitated in 1975 by Intermountain (Quivik 1999).
Sidney Mill (Denver Creek)	PineCrkSeg01	1944 - 1945	Sidney Mining Company	Ore from the Sidney Mine was not processed on site until 1944, when the Sidney Mining Company began treating its own ore in a new 50-ton flotation mill (Quivik 1999).

Table 2.1-2 (Continued)
Mills With Documented Operations in Pine Creek Watershed

Mill	Segment	Operating Years	Ownership	Comments
Sidney Mill (Red Cloud Creek)	PineCrkSeg01	1945 - 1961	Sidney Mining Company	In 1945, the Sidney Mining Company began erecting a new 250-ton selective flotation plant on Red Cloud Creek. The new mill was operated intermittently until about 1957. A cleanup of the mill was completed in 1962 (Quivik 1999).

[a]Leased to this company.
Source: Quivik 1999.

Table 2.2-1
Summary of Aquifer Parameters of the Smelterville Flats-Bunker Hill Upper Aquifer

Hydrostratigraphic Unit	Horizontal Hydraulic Conductivity (ft/day)	Vertical Hydraulic Conductivity (ft/day)	Transmissivity 2 (ft /day)	Storativity (unitless)	Effective Porosity
Upper Aquifer	500 - 10,790	0.0025[a]	10,002-216,852	0.0015-0.09	23.6-29.0

[a] Based on one test conducted on a sample of upper aquifer alluvium from borehole GR-26U (see Part 1, Figure 3.2-1) at 13.5 feet below ground surface. No units given in original source document.

Source: MFG (1992)

Table 2.3.1-1
Summary of Discharge Data From Project Database
Segments PineCrkSeg01 to 03

Segment Name	Site Location		Measured By	No. of Readings	Beginning Date	Ending Date	Minimum Discharge	Maximum Discharge	Units
PineCrkSeg01	PC	306	URS, USGS	3	11/13/97	05/23/99	0.801	63	cfs
PineCrkSeg01	PC	307	IDEQ, URS, USGS	43	10/29/93	05/15/98	0.54	38.1	cfs
PineCrkSeg01	PC	308	IDEQ, URS, USGS	36	10/29/93	05/15/98	0	2	cfs
PineCrkSeg01	PC	309	URS	2	11/12/97	05/15/98	2.7	13.8	cfs
PineCrkSeg01	PC	310	URS	1	11/12/97	11/12/97	0.163	0.163	cfs
PineCrkSeg01	PC	312	URS	2	11/11/97	05/14/98	15.3	70.6	cfs
PineCrkSeg01	PC	322	URS	1	05/15/98	05/15/98	7.14	7.14	cfs
PineCrkSeg01	PC	323	URS	1	05/15/98	05/15/98	0.88	0.88	cfs
PineCrkSeg01	PC	324	URS	1	05/17/98	05/17/98	0.27	0.27	cfs
PineCrkSeg01	PC	325	URS	1	05/17/98	05/17/98	0.135	0.135	cfs
PineCrkSeg01	PC	326	URS	1	05/18/98	05/18/98	0.07	0.07	cfs
PineCrkSeg01	PC	328	URS	1	05/18/98	05/18/98	0	0	cfs
PineCrkSeg01	PC	338	URS	1	05/15/98	05/15/98	43.7	43.7	cfs
PineCrkSeg01	PC	360	URS	1	05/15/98	05/15/98	72.5	72.5	cfs
PineCrkSeg02	PC	311	URS, USGS	3	11/12/97	05/23/99	19.9	412	cfs
PineCrkSeg03	PC	100	URS	1	11/16/98	11/16/98	295	295	cfs
PineCrkSeg03	PC	303	USGS	1	08/14/97	08/14/97	23.1	23.1	cfs
PineCrkSeg03	PC	305	EPAREG10, IDEQ, MFG, USGS	43	05/14/91	02/04/97	4.58	2030	cfs
PineCrkSeg03	PC	313	IDEQ, URS, USGS	9	04/24/97	11/16/98	9.33	1570	cfs
PineCrkSeg03	PC	314	URS	2	11/11/97	05/14/98	10.6	11.9	cfs
PineCrkSeg03	PC	315	URS, USGS	3	11/04/97	05/25/99	60	1380	cfs
PineCrkSeg03	PC	339	IDEQ, URS, USGS	24	05/16/98	08/31/99	5	1340	cfs

Table 2.3.2-1
Estimated Recurrence Intervals, Pine Creek at Mouth

Recurrence Interval (Years)	Flood Insurance Study Pine Creek at Mouth Estimated Peak Flow (cfs)
2	not available
5	not available
10	3,885
25	not available
50	8,525
100	11,380

Table 2.3.2-2
Precipitation Summary and Discharge Comparison for Water Year 1999
Kellogg, Idaho
NOAA Cooperative Station 104831

Climate Indicators	Monthly Totals												
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Annual
Total Precipitaiton (in)	1.4	7.5	5.3	4.6	5.7	5.1	1.7	1.5	2.7	0.5	1.3	0.4	37.8
Total Snowfall (in)	0.0	0.8	11.0	5.2	13.1	5.1	0.3	0.0	0.0	0.0	0.0	0.0	35.5
Average Precipitation for Period of Record (in)	2.7	3.8	3.9	3.7	2.8	2.9	2.4	2.5	2.2	1.0	1.1	1.7	30.8
Average Snowfall for Period of Record (in)	0.3	5.0	14.1	18.5	10.1	5.6	0.7	0.0	0.0	0.0	0.0	0.0	54.3
Mean Monthly Discharge (cfs) (Pine Creek at Amy Gulch)	13.6	60.7	167.7	213.8	178.2	326.5	367.2	542.1	375.9	75.2	29.4	17.7	197.4

Note:
cfs - cubic feet per second

3.0 SEDIMENT TRANSPORT PROCESSES

The physical processes of rain falling on soil, runoff from snowmelt or precipitation, channel bank and bed erosion, or mass movements incorporates sediment into streams of water. Water in streams transports, deposits, and sorts the delivered sediment based on the stream energy, discharge, and size and quantity of sediment.

Sediment transport by streams is a natural process; however, human activities such as mining, logging, road building, urbanization, or land clearing can significantly increase the rate at which sediment transport occurs. For instance, land clearing provides exposed soil and rock that may be subject to erosion. Further, this disturbance may decrease the amount of water storage in the soil, increasing runoff rates and providing additional surface water and energy for sediment transport.

The rate at which sediment passes through a cross section of a stream system is referred to as the sediment yield. For purposes of this discussion, sediment yield will be referred to in units of tons per square mile per year. This annual sediment yield may be broken down into components that describe the method of transport, suspended load and bedload. Suspended load consists of particles small and light enough to be carried downstream in suspension by shear and eddy forces in the water column. Bedload consists of larger and heavier particles that move downstream by rolling sliding or hopping on the channel bed (Dunne and Leopold 1978).

All sediment motion downstream is dictated by the shear and gravitational forces acting at a given time and place within the channel. For sediment transport purposes, gravitational forces are essentially constant. Shear forces, however, are dynamic through space and time and are dependent upon the location, depth of water, and slope of the water surface. Sediment transport occurs at even the smallest of stream channel discharge but the majority of movement occurs during moderate to high discharge when shear forces are greatest (Leopold et. al. 1992)

Sediment derived in Pine Creek is transported to the South Fork Coeur d'Alene River. Likely sediment sources in Pine Creek include are mine wastes, rock debris situated adjacent to channels, mobilization of channel bed sediment, and bank erosion. Based on USGS sediment transport and stream discharge data, approximately 2,900 tons of sediment was transported past the USGS gage station on Pine Creek during water year 1999. In this discussion, the available information and analyses, and likely sources are described.

3.1 AVAILABLE INFORMATION

One year of sediment transport gaging data is available for Pine Creek. The USGS installed a stream gaging station (Pine Creek below Amy Gulch near Pinehurst, number 12413445) and began reporting hydrologic data for water year 1999 (October 1, 1998 through September 31, 1999) (USGS 2000a). Associated with this gage, the USGS established suspended and bedload sampling locations. To date, data from eight suspended load and six bedload sampling events are available. The suspended load data were further divided into sand and fines fractions. The suspended and bedload sampling events were completed over a range of stream discharges to establish a rating curve relating sediment discharge to stream discharge. In addition, sampling was completed on both the rising and falling limbs of high water events to examine the transport during these differing conditions. Instantaneous stream discharge was recorded at the time of sampling for use in rating curve development.

Mean daily discharge estimates prior to 1999 have been calculated, as outlined in Section 2.3. These estimates were developed based on relationships between the discharge patterns in Pine Creek as compared to Placer Creek for which discharge data prior to 1999 has also been collected.

In addition to the gaging data, historical and current aerial photography is available. For Pine Creek, 1998 photographs by URS Greiner, Inc., and CH2M HILL, Inc. (URSG and CH2M HILL 1999) and 1991 photographs by U.S. Department of Agriculture (USDA) (USDA 1991) were reviewed.

3.2 ANALYSES

3.2.1 USGS Sediment Gaging Data

The USGS sediment transport data from the station at on Pine Creek were analyzed in general accordance with the Army Corps of Engineers (USACE) guidance manual for sedimentation investigation (USACE 1989). Sediment rating curves were developed by relating measured stream discharge to measured sediment discharge. These curves were integrated with the stream discharge for water year 1999, and estimates of historical stream discharge, to produce estimates of annual sediment yield for the Pine Creek. These sediment transport data were further examined to delineate threshold discharges where different particle size classes become mobile.

The USGS sediment discharge station on Pine Creek is located approximately 3 miles upstream of the mouth. As such, these data are expected to be representative of sediment discharge for most of the Pine Creek Watershed.

The suspended sediment data for the station on Pine Creek are presented on Figure 3.2-1, with rating curves established for the sand fraction, and the fine fraction. The stream discharge presented is the instantaneous discharge noted at the time of sampling. The correlation analysis used to establish the curves is a power function that calculates the least squares fit through the points. The grain size break between sand and fines is 63 microns.

The relationships indicated on Figure 3.2-1 were integrated with the mean daily discharge data from USGS gage 12413445, Pine Creek near Pinehurst (USGS 2000b), to obtain mean daily suspended sediment discharge for water year 1999. Like the original data, the sand and fines fractions were calculated separately and summed to estimate the total suspended sediment discharge. Cumulative sediment discharge for water year 1999 year was calculated by summing the mean daily sediment discharges. The results are presented in Figures 3.2-2 through 3.2-4. With a drainage area of approximately 77 square miles, the total suspended sediment yield for the Pine Creek Watershed for water year 1999 was approximately 12 tons per year per square mile. Of that, approximately 7 tons was sand and 5 tons was fines. A total of approximately 900 tons of suspended sediment was transported past the Pine Creek gage in water year 1999.

A similar analysis was completed for the bedload sediment data. The USGS provisional report titled *Sediment Transport in the Coeur d'Alene River Basin of Northern Idaho* (USGS 2000c) presents the rating curves and regression relationship for bedload transport at the Enaville gage. As with the suspended sediment data, the regression relationship for bedload was integrated with the mean daily discharge hydrograph to obtain daily and cumulative bedload discharge for water year 1999. These results are presented in Figure 3.2-5. Based on the USGS data, annual bedload sediment yield was approximately 26 tons per year per square mile for Pine Creek in water year 1999 for a total of about 2,000 tons.

Summing the total suspended load and bedload sediment gives the total sediment yield for the Pine Creek Watershed for water year 1999 as approximately 37 tons per square mile, or a total of 2,900 tons. Water year 1999 appears to be typical from a water and snow budget perspective as discussed in Section 2.3; however sediment yields can vary significantly from year to year based on hydrologic conditions, sediment inputs, changing land use, and other conditions.

As indicated by the USGS data, the majority of sediment transport occurs during high flow events. Much larger discharge events are likely in the Pine Creek than were observed during water year 1999. During larger events, much more additional sediment load should be expected. Peak discharges predicted by the Flood Insurance Study, for the mouth of Pine Creek are 3,885 cfs for a 10-year event and 11,380 cfs for a 100-year event (FIA 1979).

Review of Figures 3.2-2 through 3.2-5 indicates the majority of sediment transport occurred during discrete periods with approximate dates of December 1 to 4, December 29 to January 2, January 14 to 23, February 24 to March 4, March 23 to 27, April 19 to 27, and May 19 to June 6. High temperatures, rainfall, and snowmelt caused large stream discharges during these periods, which is discussed in Section 2.3. These high stream discharges mobilized and transported the vast majority of the sediment yield for water year 1999. Similar high sediment transport rates would be expected on a seasonal basis, as snowmelt in the upper watershed mobilizes and transports sediment through the system.

To estimate sediment transport in years before water year 1999, the estimated discharge based on Placer Creek data, described in Section 2.3, were integrated with the sediment transport relationships developed for Pine Creek in 1999. The results are presented in Table 3.2-1. As described in Section 2.3, there is a 40 to 60 percent variation in measured verses estimated discharge that would likely have a similar impact on sediment transport. In addition, extrapolation of the rating curves to stream discharges greater than discharges that were used to develop the rating curved needed to be employed. Nevertheless, a wide range of sediment transport quantities is indicated. In this type of analysis, the quantity of sediment is directly correlated to the magnitude and duration of stream discharge. Years with high peak discharge and long duration will produce more sediment than years with low discharge and short duration. This information is presented in Figures 3.2-6 through 3.2-8. These figures present estimates of cumulative sediment transport (for fines, sand, and bedload, respectively) through time, for example water years 1991 to 1999. A wide range of sediment transport rates is estimated.

To identify potential thresholds of sediment transport based on the USGS data, calculated estimates of daily sediment discharge for sand, fines, and bedload were examined. For each daily estimate and size class, for water year 1999, the percentage of total annual sediment discharge was calculated. These values were plotted against stream discharge and percent of maximum daily discharge for water year 1999 (Figure 3.2-9). As would be expected, this figure indicates increasing sediment discharge with increasing stream discharge. For both suspended load (sand and fines) and bedload, rapid increases in sediment discharge occur at stream discharges at or above approximately 800 cfs for water year 1999. Although this analysis is based on a few measurements of sediment concentration, it provides guidance to discrete stream discharges where increased sediment transport may be expected.

Additionally, Figure 3.2-9 suggests that approximately 68 percent of the total annual sediment discharge in Pine Creek was bedload, 17 percent was sand, and 14 percent was fines.

3.2.2 Channel Classification

Channel classifications may provide a level of understanding and description of a channel behavior. Some channel classification systems require fieldwork and in-depth study, while others only require topographic map and aerial photograph interpretation. The level of information provided by a classification based solely on topographic map and aerial photograph interpretation is limited but does provide a basic framework for channel processes and conditions.

Rosgen (Rosgen and Silvey 1996) proposed a classification that delineates channel types based on plan-view morphology, cross-section morphology, channel sinuosity, channel slope, and bed features to provide a broad level delineation. Aerial photograph and topographic map interpretation can be used for this type of classification, Level 1. The Rosgen methodology builds from this broad classification when combined with more detailed information. The Rosgen Level 1 classification was used for this study to identify broad reach level channel morphologies.

Additional information on stream channel classifications available from the Idaho Division of Environmental Quality's Beneficial Use Reconnaissance Project (IDEQ/BURP) is currently under review and will be incorporated into the Draft RI report. IDEQ/BURP information is based on field surveys and offer greater resolution, for the limited areas surveyed, than available topographic maps and aerial photographs. Based on this information, some channel classifications presented in this report may change.

Electronic USGS 7 ½ minute quadrangle maps containing three dimensional topographic data were analyzed using AutoCAD Land development software. Plots of channel profile and slope were produced for PineCrkSeg01 and PineCrkSeg03, Figures 3.2-10 through 3.2-11. In general, the divisions between segments were established based on changes in channel type or other morphologic feature. As such, each segment contains one or two channel types. The channel type was determined based on channel slope and observation of aerial photographs from 1998. Further description of the aerial photographs and topographic maps, current and historical, is contained in a separate section.

Channel stationing was established from the confluence of Pine Creek with the South Fork at 100-foot stations upstream from the mouth for ease of locating specific features. This stationing is indicated on Figures 3.2-10 through 3.2-12. This stationing is approximate and is intended for general locating of discussed areas, more detailed stationing and survey should be used for precise locating, and project construction.

In the portion of the Pine Creek Watershed that was evaluated, two Rosgen stream types occur, "B," and "C." The following paragraphs briefly summarize these two types of channel and the mapping effort of channel classification.

"B" stream types are moderately steep to gently sloped channels, 2 to 4 percent. Faults, joints, contacts often influence "B" type channels by restricting the development of wide floodplains. Stream erosion rates, aggregation and degradation rates are generally low. Lateral movement of "B" type channels is typically low. Rapids and scour pools are typical bed forms in type "B" channels.

"C" stream types generally are located in valleys constructed from alluvial deposition, with well-developed floodplains. Primary morphologic features of the "C" stream type are the sinuous low relief channel, and the well-developed floodplain built sediment derived from the river. Lateral migration, aggregation and degradation rates in "C" type channels are dependent on the stability of the banks, discharge and sediment supply from upstream. "C" type channels may be significantly altered by changes in bank stability, discharge, or sediment supply

The channel types within Pine Creek Watershed are identified on the topographic maps, Figures 3.2-10 and 3.2-11. Based on the topographic maps and sections, segment PineCrkSeg01 contains type "C" and type "B" channels. Segment PineCrkSeg03 contains only a type "C" channel.

IDEQ developed a Rosgen classification for a 100-meter reach of channel in PineCrkSeg01 under the BURP project (see Figures 3.2-11 and 3.2-12). This reach was selected to be representative of general conditions in that area of the watershed. The reach was classified as Rosgen type A in the BURP study (IDEQ 1998, 1999). The differences between the BURP classification and the results presented here are most likely due to differences in the methods used to classify the channel. This classification is based on maps, elevation profiles derived using a GIS-based analysis, and aerial photographs. The BURP classification is based on field observations and channel measurements. Both classifications are preliminary in nature and are presented here for baseline characterization purposes only. They are not intended for use in the design phase of remediation planning. Detailed, site-specific hydrologic studies may be needed to guide actual remedial design development.

3.2.3 Channel Descriptions

The 1998 set of aerial photographs by URS Greiner, Inc., and CH2M HILL, the 1991 set by USDA, and the topographic map and profile presented in Figures 3.2-10 through 3.2-12 were reviewed to further describe Pine Creek. This review and interpretation focused on morphologic features indicating stream instability, channel migration, channel aggregation or degradation and other features that may contribute sediment to the system.

3.2.3.1 Segment PineCrkSeg01 (Station 270+00 to 540+00)

Segment PineCrkSeg01 has approximately 28,000 feet (5.3 miles) of mapped channel, as indicated in Figure 3.2-10. Photographic coverage extended to station 540+00. Through this section, Pine Creek flows through a valley bottom typically 200 to 300 feet wide. In areas, the channel appears to be confined by hillslopes. Channel slope varies from 1 to 8 percent. In general, the valley bottom is unvegetated and consists of river gravel. Evidence of relict channels, and migration is abundant through this segment. Several cuts, mines and tailings deposits are situated adjacent to the channel within this segment. Likely sediment sources in this segment are apparently from the cuts, mines, tailings deposits, waste rock piles, lateral migration, and channel bed remobilization.

From station 270+00 to 338+00, Pine Creek flows through a valley bottom approximately 200 feet wide with few constraints on channel location. Channel slope is approximately 1 percent. Unvegetated gravel in a band 100 to 200 feet surrounding the active channel indicates frequent movement. Both the 1991 and 1998 aerial photographs indicate the gravel may have been reworked to construct a dike to constrain the channel on the southwest bank from approximate station 320+00 to 335+00. Likely sediment sources in this reach include channel bed remobilization, minor bank erosion, and lateral migration.

Pine Creek from Station 338+00 to 370+00 is constrained in location by steep valley walls, bridge abutments, and road embankments. Channel slope is approximately 1 to 2 percent. Several tributaries enter Pine Creek within this section that may contribute sediment to the system. At approximate station 338+00, a tributary channel enters Pine Creek. This tributary flows adjacent to and through the tailings dam and mine and millworks of Nabob Mine. This tributary is likely to contribute sediment to the system. Other likely sediment sources in this reach are channel bed remobilization, minor bank erosion and sediment from the tributary channels.

From station 370+00 to 414+00, the channel exhibits a meandering pattern with little or no vegetation on the banks. Channel slope is approximately 1 to 2 percent. From station 370+00 to 382+00, an exposed rock cut is located adjacent to the channel. Likely sediment sources in this reach are channel bed remobilization, bank erosion, lateral migration and sediment derived from the exposed rock cut.

Pine Creek from station 414+00 to 480+00 flows through a valley approximately 200 feet wide with a slope of approximately 2 percent. The channel displays a braided pattern with relict channels. Little or no vegetation in the braid zone indicated frequent sediment movement. Likely sediment sources in this reach are channel bed remobilization, minor bank erosion, and channel migration.

From station 480+00 to 540+00, the channel slope increases and becomes more confined by steep valley walls, minor meandering is still evident. Exposed rock debris is situated directly adjacent to the channel from the Constitution Mine from station 520+00 to 540+00. The likely sediment sources in this reach include exposed deposits surrounding the Constitution Mine, channel bed remobilization, and minor bank erosion.

3.2.3.2 Segment PineCrkSeg02 (Station 270+00 to 540+00)

Aerial photographs were not available for review of this segment. No slope profiles were developed.

3.2.3.3 Segment PineCrkSeg03 (Station 00+00 to 270)

Segment PineCrkSeg03 has approximately 27,000 feet (5.1 miles) of mapped channel, Figure 3.2-11. Channel slope ranges from 0.5 to 1.5 percent. Likely sediment sources in segment PineCrkSeg03 are channel bed remobilization, minor bank erosion, lateral migration and possibly rock debris piles adjacent to the stream. There have been removal actions at mines such as the Amy-Matchless, Liberal King, and Douglas, which may have a local effect on sediment movement in the channel.

From station 00+00 to 18+00, the channel slope is approximately 0.5 percent. The confluence with the South Fork has a braided pattern, and several channels may serve as the confluence depending on the stage. Likely sediment sources include channel bed remobilization and lateral migration.

Pine Creek from station 18+00 to 78+00 is confined in location by dikes adjacent to the I-90 embankment. Intermittently (at lower flows), surface water may be absent over this reach; water is not visible in the 1998 photographs in this reach. Likely sediment sources are channel bed remobilization and minor bank erosion.

From station 78+00 to 115+00, Pine Creek displays a braided pattern with little or no vegetation on the banks. The channel is located in different locations in the photographs reviewed indicating channel migration. Likely sediment sources in this reach are channel bed remobilization, bank erosion and channel migration.

Pine Creek from station 115+00 to 127+00 is constrained by dikes on both banks. Channel slope is approximately 0.5 percent. Lateral gravel bars are developed on both banks. Little or no vegetation exists on the gravel bars. Sediment sources in this reach include channel bed remobilization, and minor bank erosion.

From station 127+00 to 152+00, the channel slope is approximately 0.5 percent. The channel exhibits a braided pattern and occupies different locations in the 1991 and 1998 photographs. Little or no vegetation is visible on gravel bars surrounding the channel, indicating a mobile bed and channel migration. Likely sediment sources in this reach include channel bed remobilization and bank erosion.

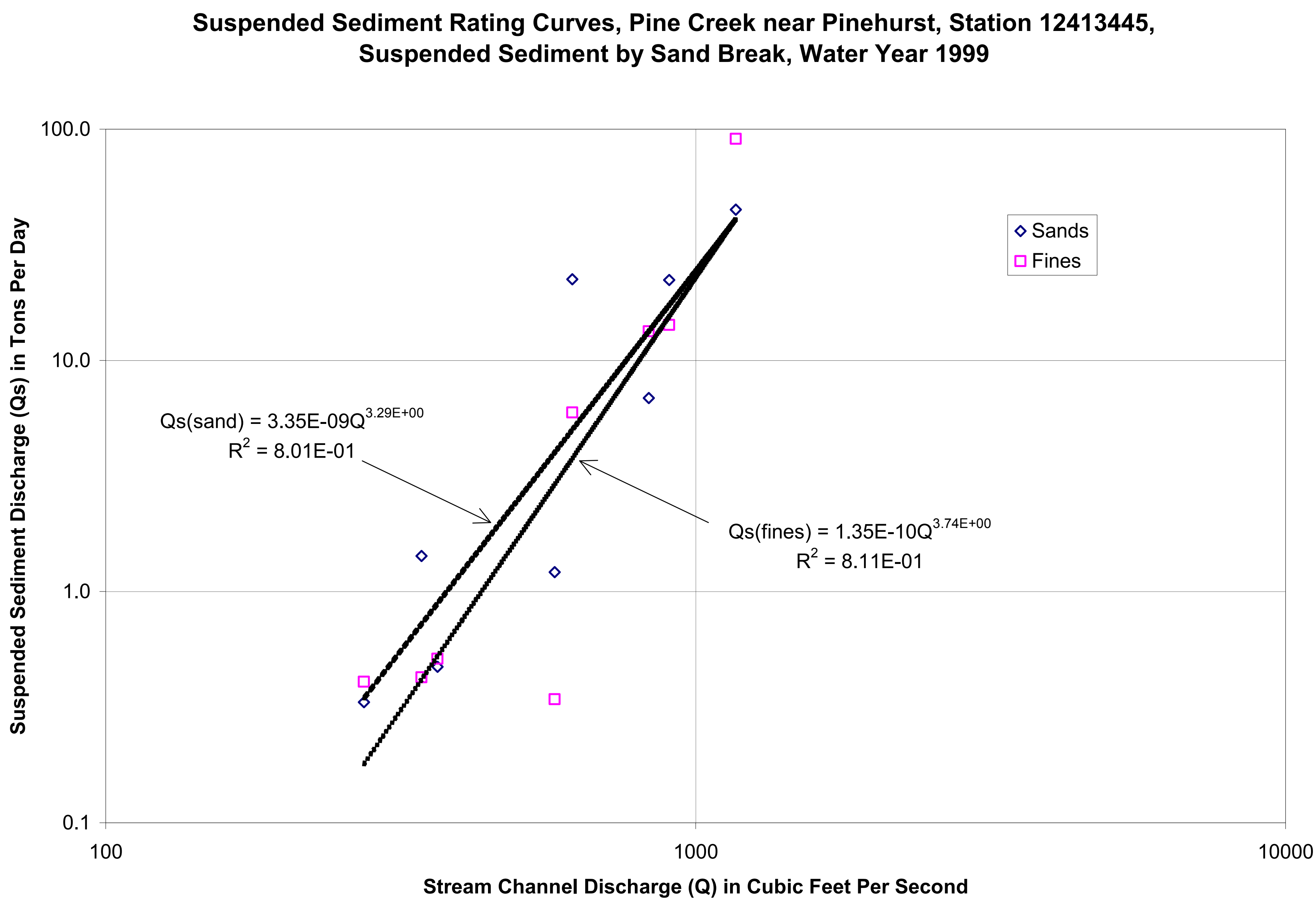
From station 152+00 to 204+00, the channel is situated in a band of exposed gravel 100 to 200 feet wide. Pine Creek exhibits a braided pattern through this reach. Channel slope is approximately 0.5 percent. From station 152+00 to 158+00, an exposed rock hillslope around the Gold Eagle Mining Company is located near the channel. However, there is no apparent surface water connection visible in the photographs reviewed. Likely sediment sources in this reach include mines, tailings deposits, waste rock piles, channel bed remobilization, minor bank erosion, and lateral migration.

From station 204+00 to 249+00, Pine Creek displays a single thread channel with possible relict channels. The channel may be channelized and the floodplain reworked as indicated by roughened surface and linear appearance. Little or no vegetation surrounds the channel in this reach. From station 237+00 to 241+00, exposed rock debris from the Liberal King Mine extends from the hillslope to the valley bottom and Pine Creek. Likely sediment sources in this reach include the rock pile from the Liberal King Mine, channel bed remobilization, and minor bank erosion.

Pine Creek from station 249+00 to 260+00 is constrained in location by bridges and possible dikes. Relict channels and linear vegetation pattern on gravel bars through this reach indicate historical channel migration. Likely sediment sources in this reach include channel bed remobilization, minor bank erosion and lateral migration.

3.3 SUMMARY

Based on the information discussed above, approximately 2,900 tons, or 37 tons per square mile, of sediment was transported in Pine Creek in water year 1999. Large fluctuations in sediment transport should be expected based on stream discharge. Extrapolation of discharge data from other watersheds in the vicinity of Pine Creek, indicate that significantly greater flows occur in Pine Creek. During larger discharges, much more sediment volume and larger particle sizes would be expected to be transported.



EPA REGION 10

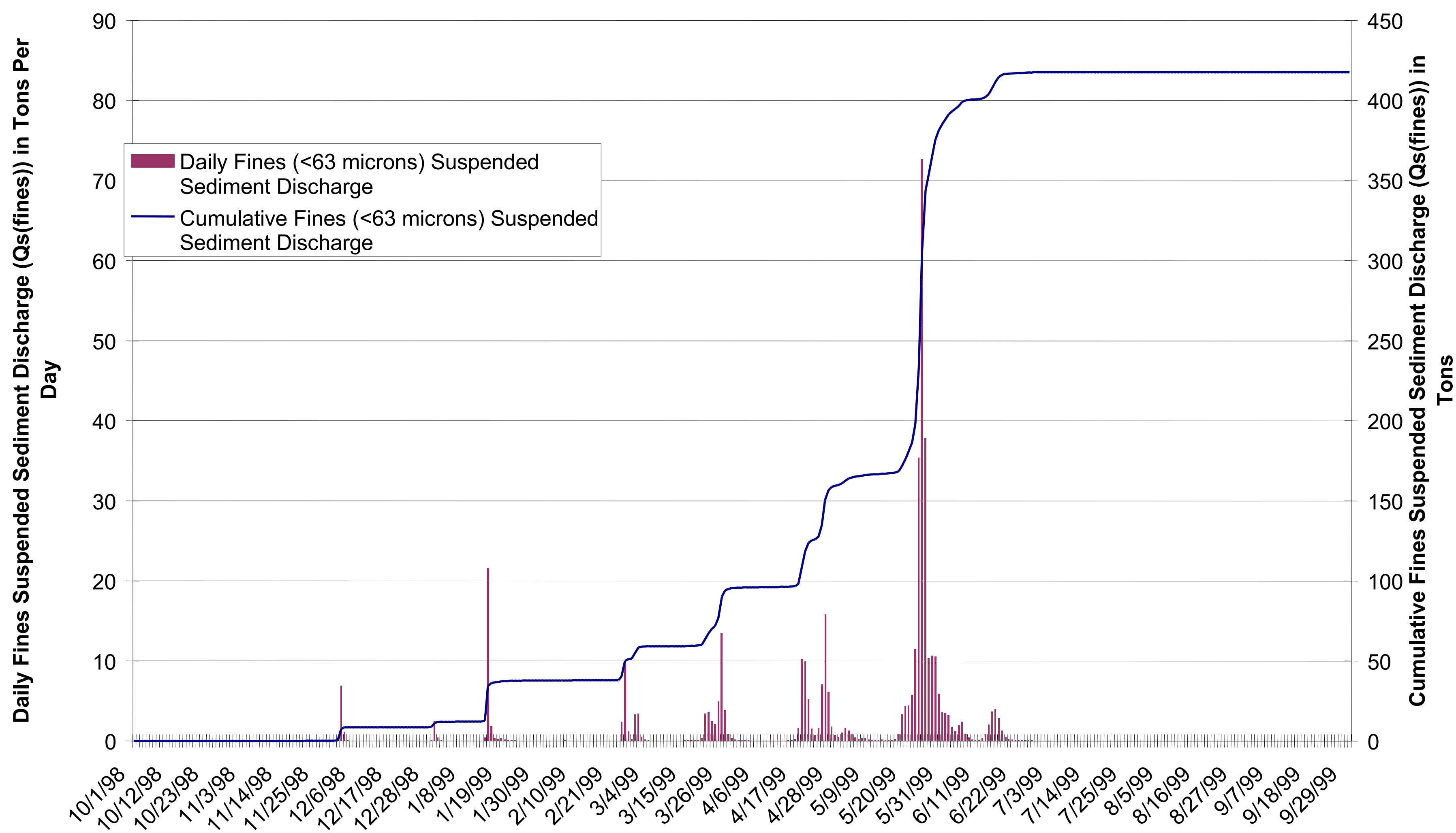
027-RI-CO-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

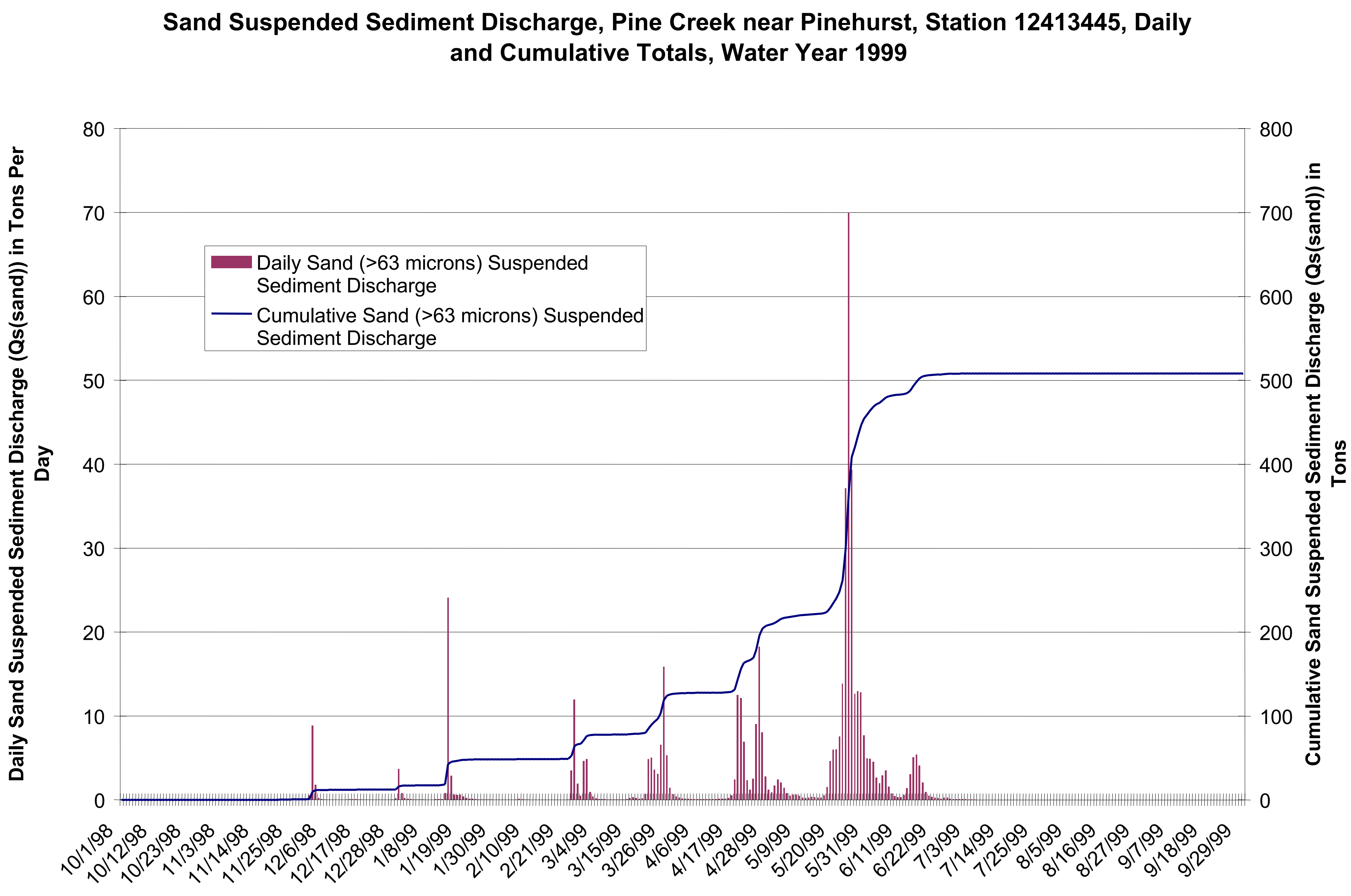
Doc Control: 4162500.6615.05.a
Generation: 1

Pine Creek Series
07/13/01

Figure 3.2-1

Fines Suspended Sediment Discharge, Pine Creek near Pinehurst, Station 12413445, Daily and Cumulative Totals, Water Year 1999





EPA REGION 10

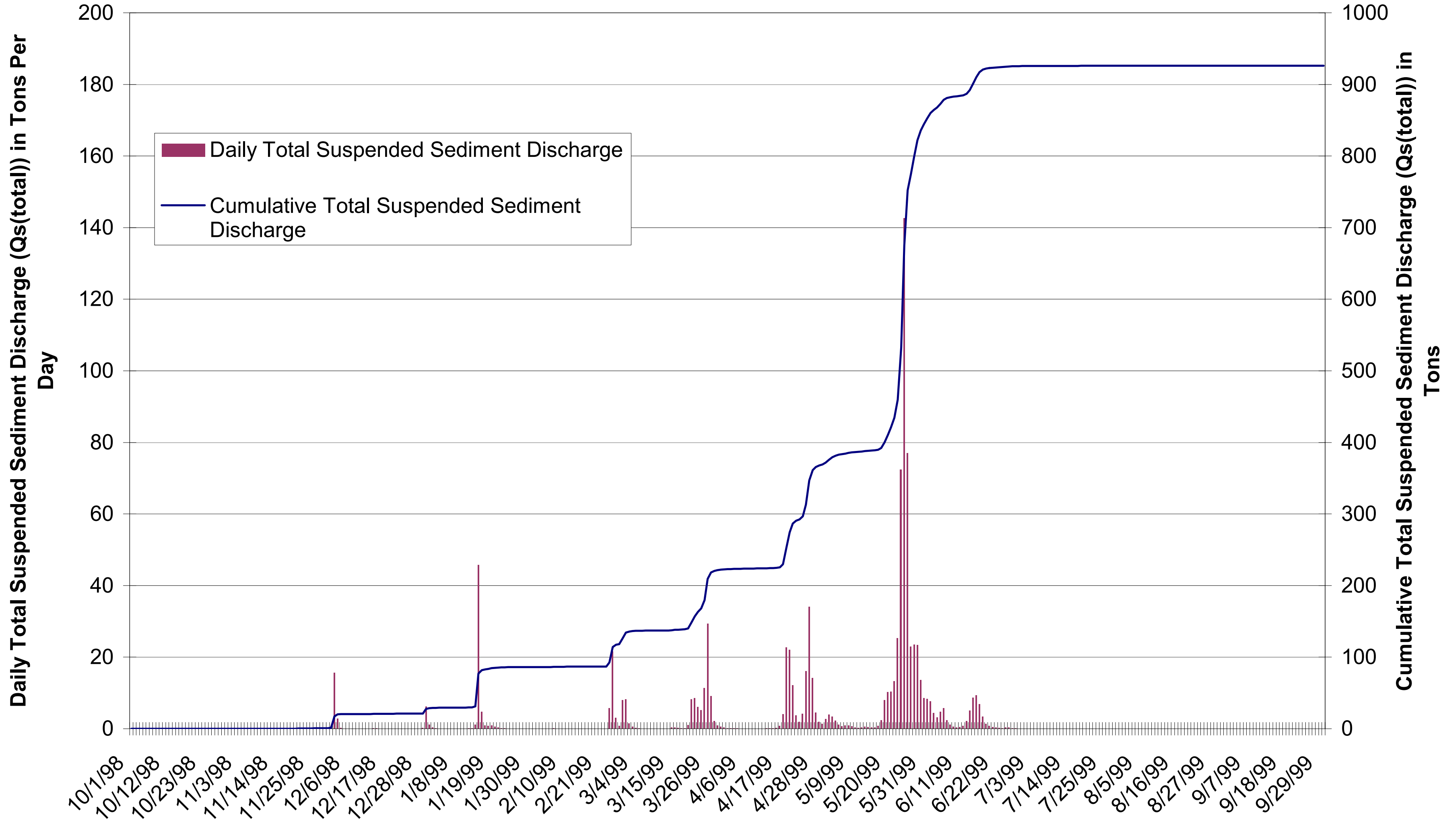
027-RI-CO-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

Doc Control: 4162500.6615.05.a
Generation: 1

Pine Creek Series
07/13/01

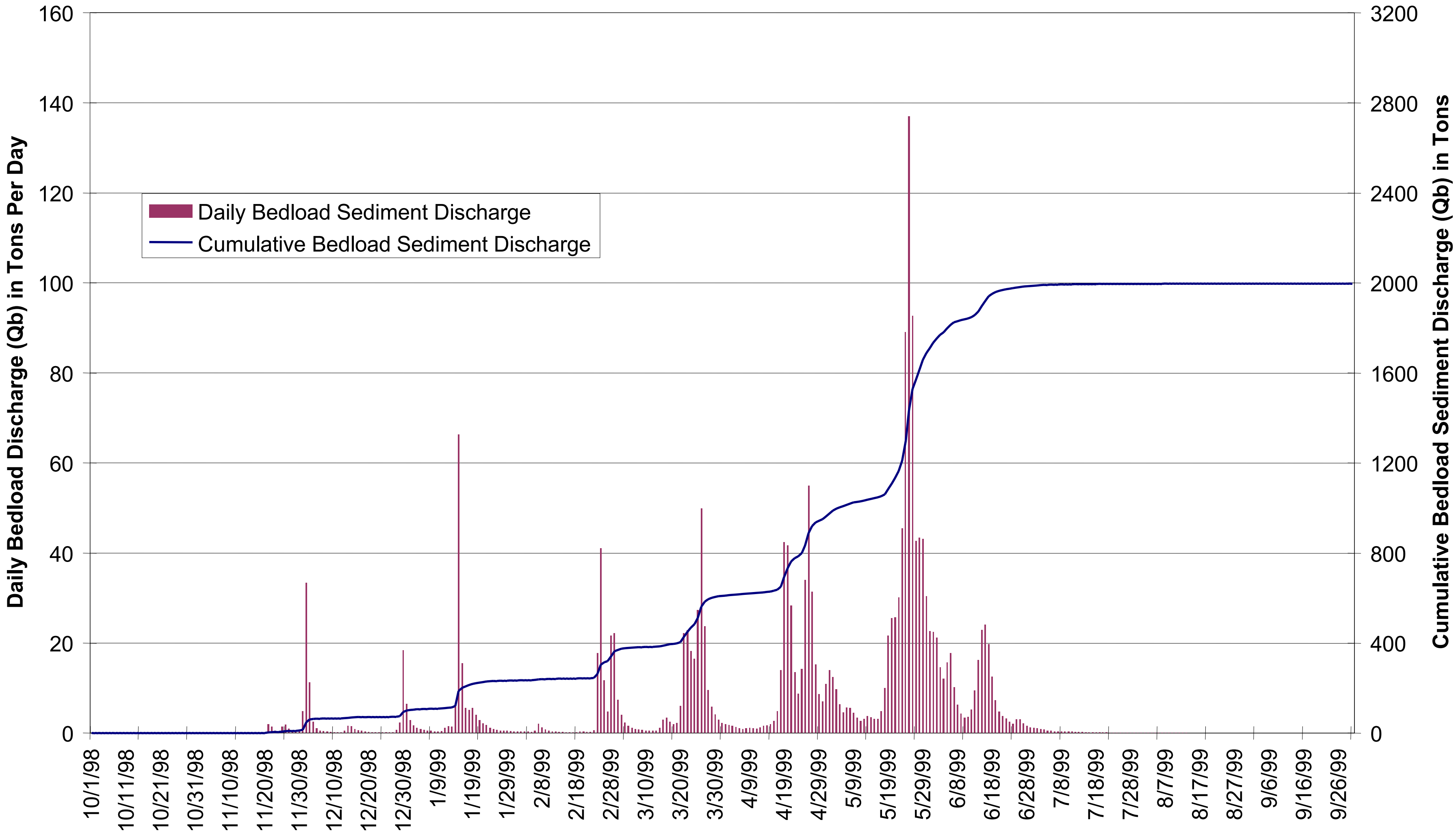
Figure 3.2-3

Total Suspended Sediment Discharge, Pine Creek near Pinehurst, Station 12413445, Daily and Cumulative Totals



EPA REGION 10	027-RI-CO-102Q Coeur d'Alene Basin RI/FS RI REPORT	Doc Control: 4162500.6615.05.a Generation: 1 Pine Creek Series 07/13/01	**Figure 3.2-4**

Bedload Sediment Discharge, Pine Creek near Pinehurst, Station 12413445, Water Year 1999



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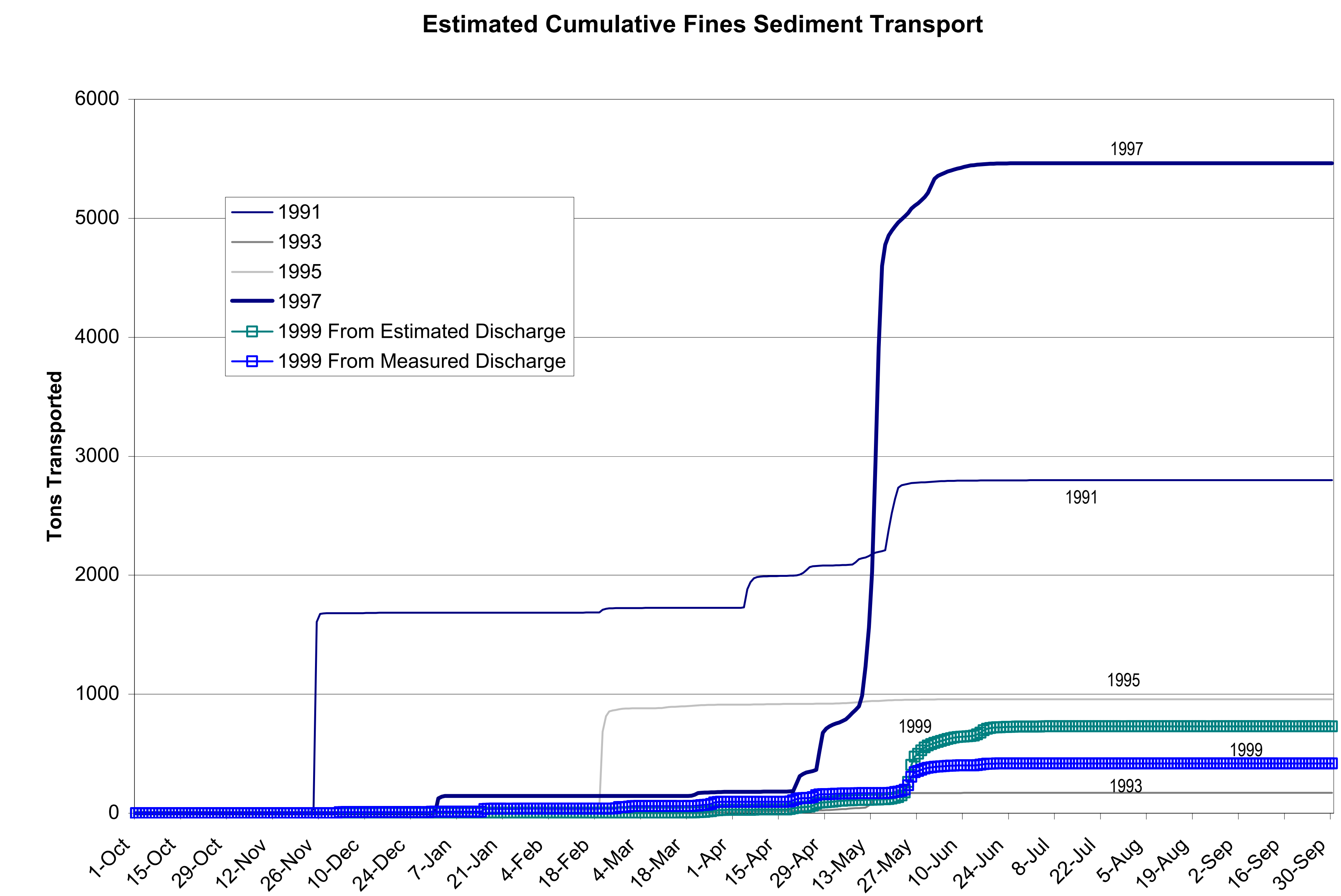
Pine Creek Series
07/13/01

Figure 3.2-5



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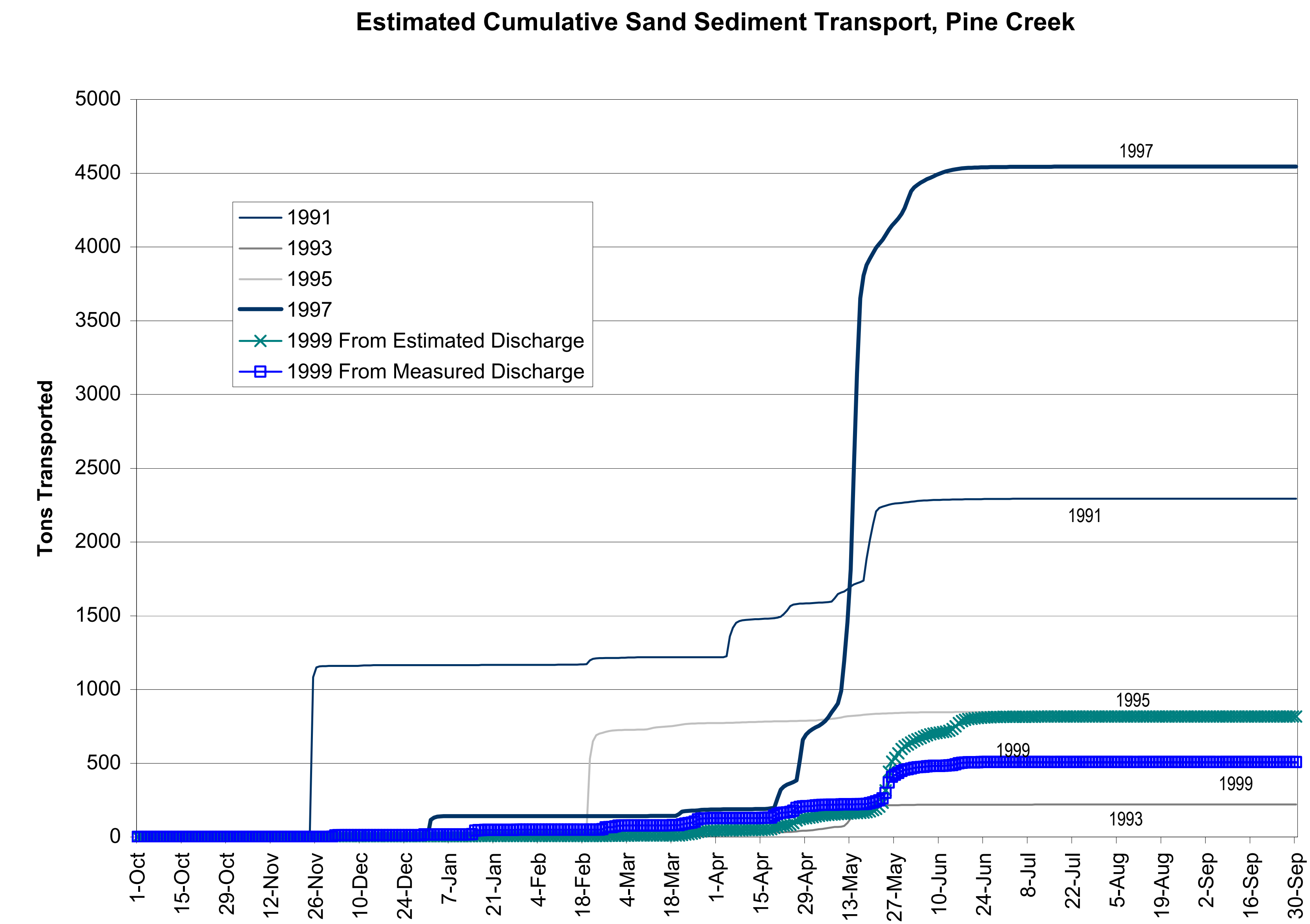
RI REPORT

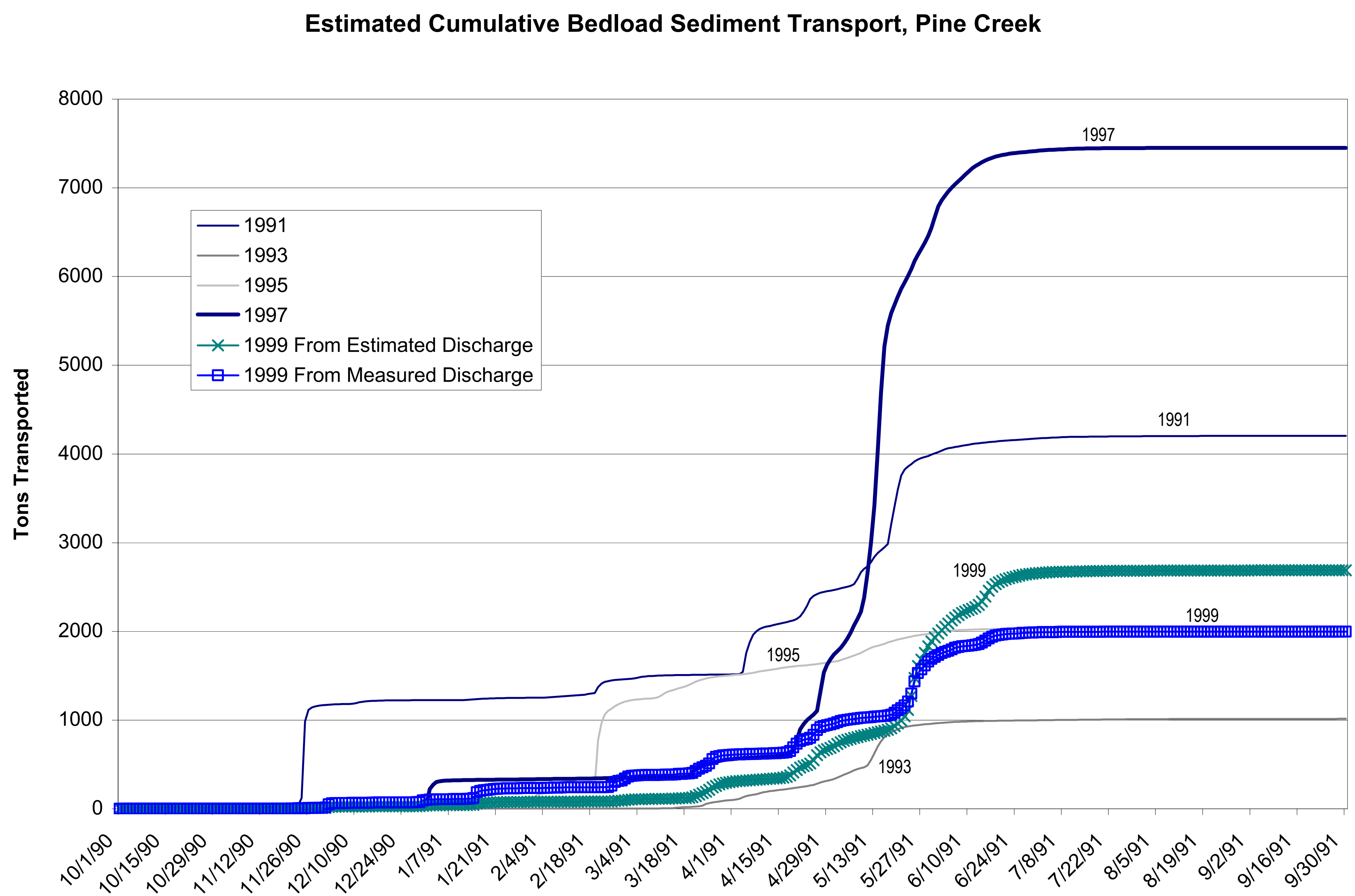
Doc Control: 4162500.6615.05.a
Generation: 1

Pine Creek Series
07/13/01

Figure 3.2-6



EPA REGION 10	027-RI-CO-102Q Coeur d'Alene Basin RI/FS RI REPORT	Doc Control: 4162500.6615.05.a Generation: 1 Pine Creek Series 07/13/01	Figure 3.2-7



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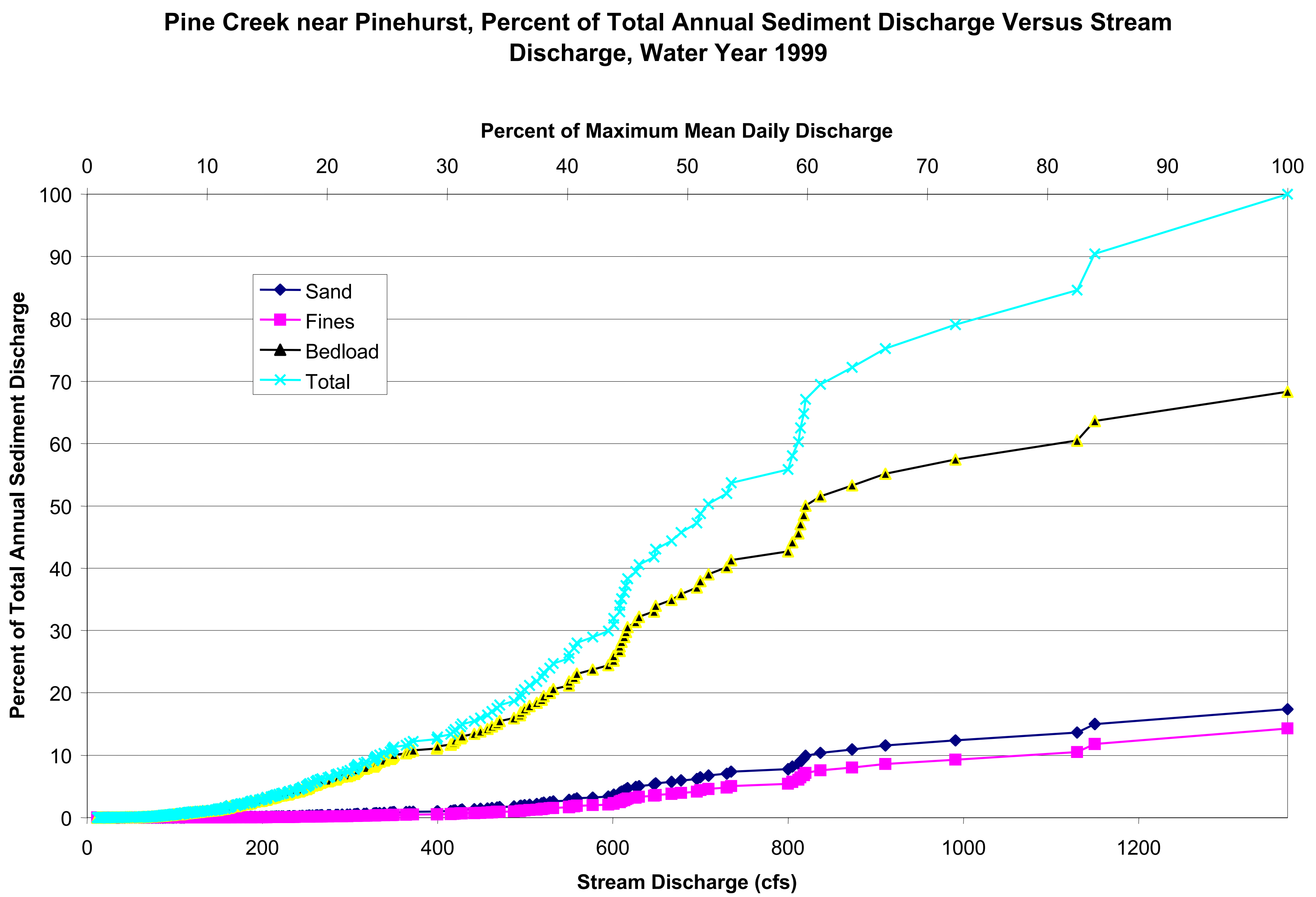
RI REPORT

Doc Control: 4162500.6615.05.a
Generation: 1

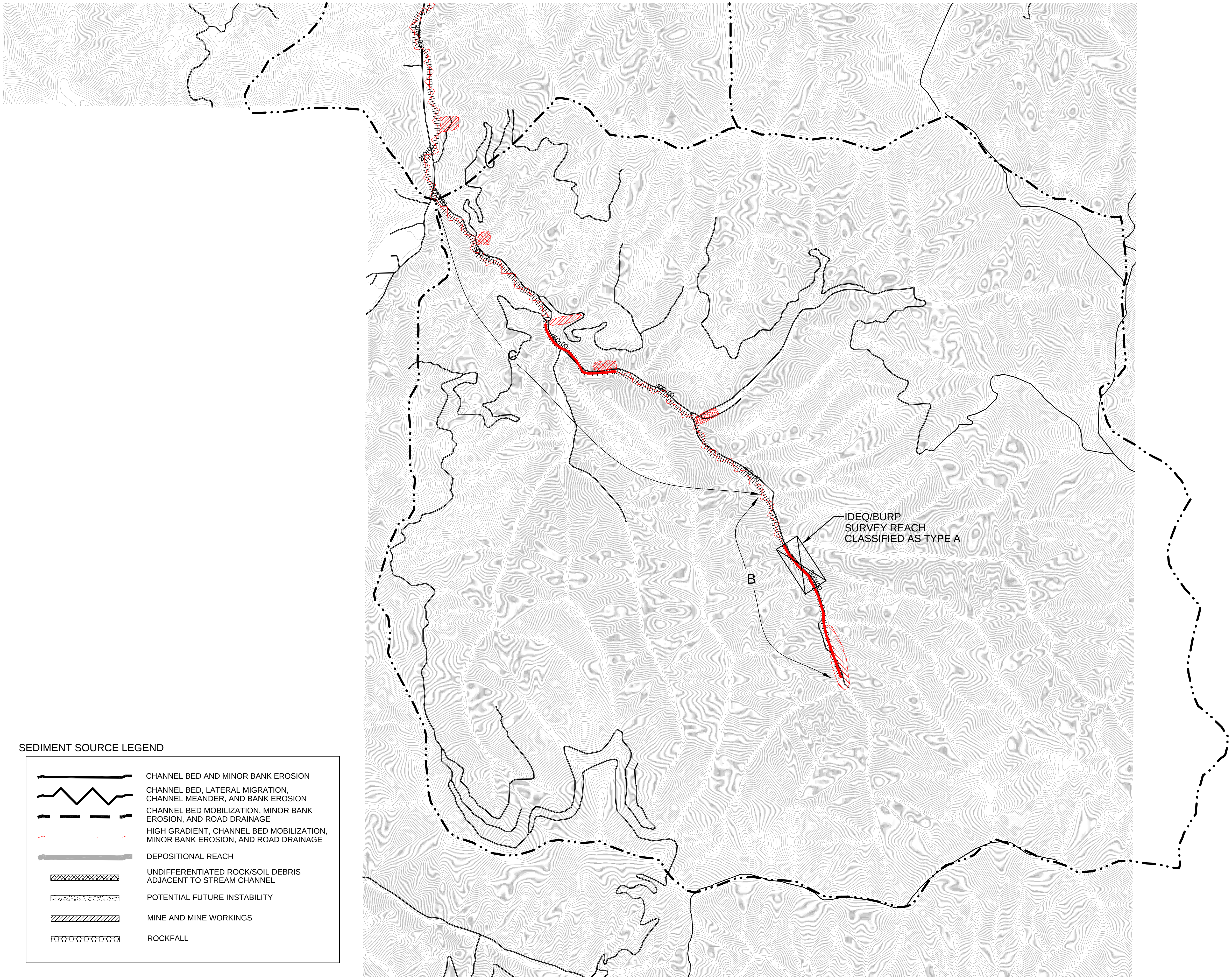
Pine Creek Series
07/13/01

Figure 3.2-8



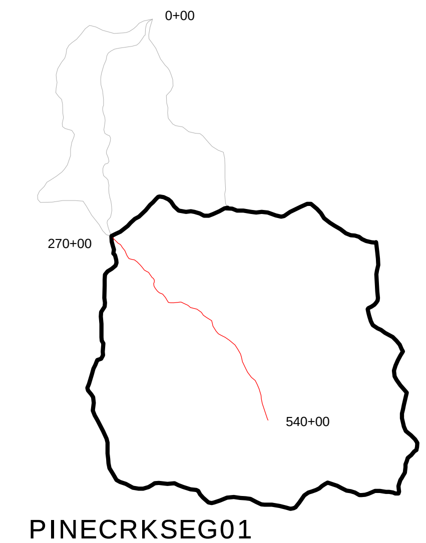
EPA REGION 10	027-RI-CO-102Q Coeur d'Alene Basin RI/FS RI REPORT	Doc Control: 4162500.6615.05.a Generation: 1 Pine Creek Series 07/13/01	Figure 3.2-9

Figure 3.2-10
Pine Creek Segment 01 Site Plan



SEDIMENT SOURCE LEGEND

- CHANNEL BED AND MINOR BANK EROSION
- CHANNEL BED, LATERAL MIGRATION, CHANNEL MEANDER, AND BANK EROSION
- CHANNEL BED MOBILIZATION, MINOR BANK EROSION, AND ROAD DRAINAGE
- HIGH GRADIENT, CHANNEL BED MOBILIZATION, MINOR BANK EROSION, AND ROAD DRAINAGE
- DEPOSITIONAL REACH
- UNDIFFERENTIATED ROCK/SOIL DEBRIS ADJACENT TO STREAM CHANNEL
- POTENTIAL FUTURE INSTABILITY
- MINE AND MINE WORKINGS
- ROCKFALL



PINECRKSEG01

LEGEND

- BASIN BOUNDARY
- CONTOUR LINE
- CHANNEL CENTERLINE
- INTERSTATE/ROAD/TRAIL
- Aa+ ROSGEN CLASSIFICATION

NOTES:

1. MAP FEATURES AND CONTOURS PRODUCED BY AMERICAN DIGITAL CARTOGRAPHY, COPYRIGHT 1995, AND BASED ON 7.5 MINUTE SERIES MAPS, REVISED 1977, ZONE ID-W.
2. VERTICAL DATUM BASED ON NAD83 IDAHO STATE PLANE COORDINATE SYSTEM.
3. CONTOUR INTERVAL IS 25 FEET.
4. CHANNEL CENTERLINE TAKEN AT APPROXIMATE LOW POINT OF STREAM CHANNEL.
5. SEDIMENT SOURCE LOCATIONS ARE APPROXIMATE AND ARE BASED ON TOPOGRAPHIC MAP AND AERIAL PHOTOGRAPH INTERPRETATION.

N
W E
S

0 4000 8000
Scale in Feet

027-RI-CO-102Q
Coeur d'Alene Basin RI/FS
RI Report

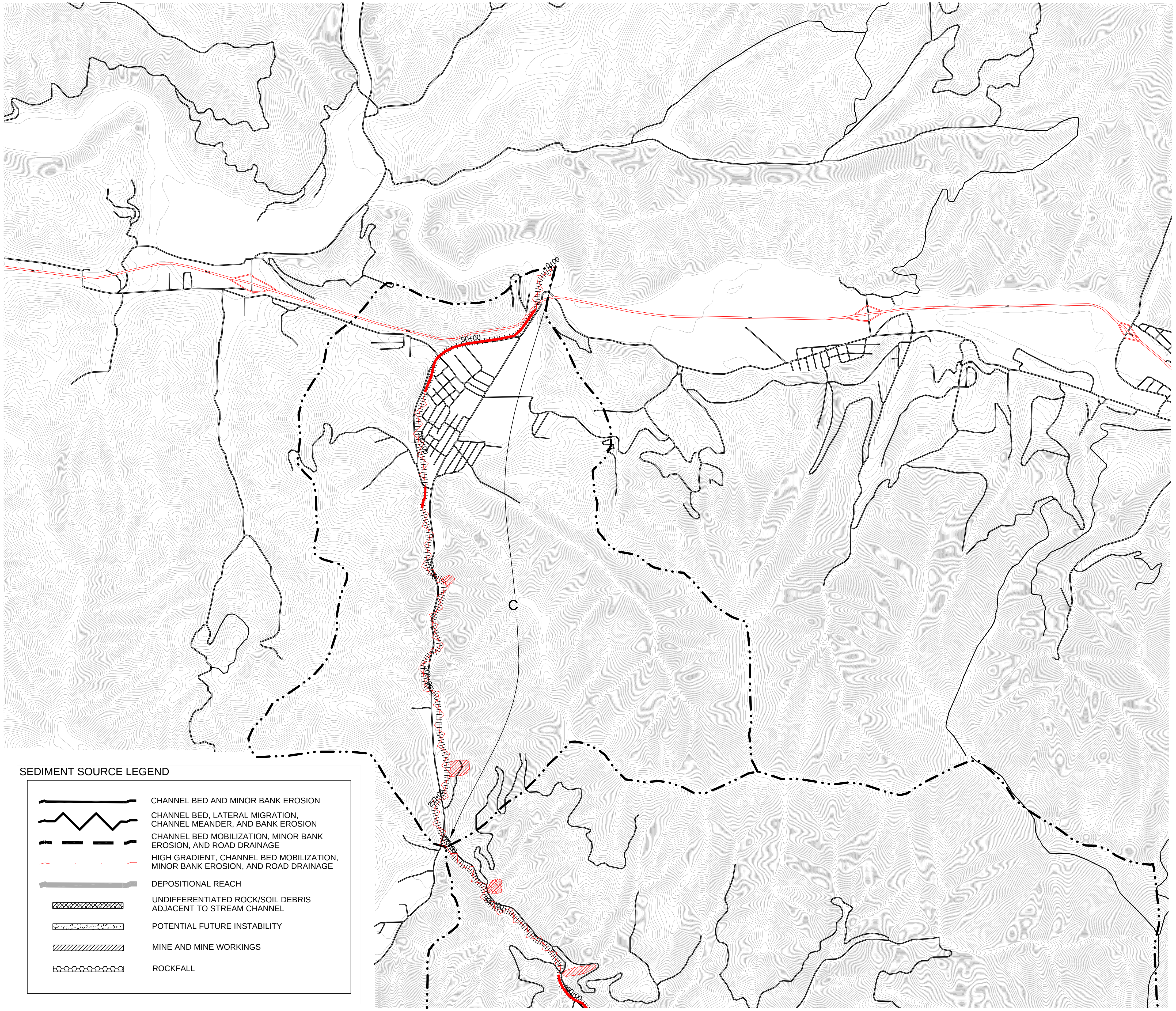
EPA REGION 10

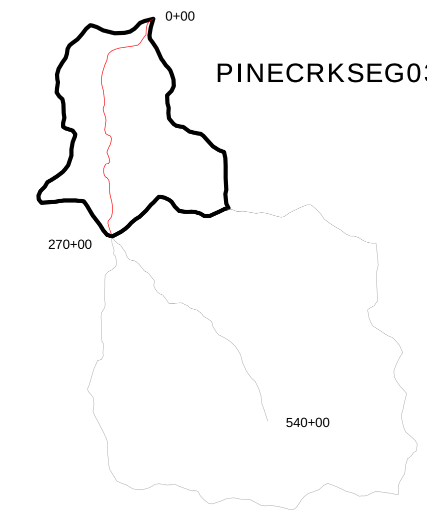
Doc. Control: 4162500.6615.05.05.a
Generation: 1
Path: N:\Coverages\Others\Shannon&Wilson\\Pine Creek\Pinecreek_Site.dwg
Layout: PineSeg01
07/26/2001

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: July 26, 2001

Figure 3.2-11
Pine Creek Segment 03 Site Plan





LEGEND

- BASIN BOUNDARY
- CONTOUR LINE
- CHANNEL CENTERLINE
- INTERSTATE/ROAD/TRAIL
- Aa+ ROSGEN CLASSIFICATION

NOTES:

1. MAP FEATURES AND CONTOURS PRODUCED BY AMERICAN DIGITAL CARTOGRAPHY, COPYRIGHT 1995, AND BASED ON 7.5 MINUTE SERIES MAPS, REVISED 1977, ZONE ID-W.
2. VERTICAL DATUM BASED ON NAD83 IDAHO STATE PLANE COORDINATE SYSTEM.
3. CONTOUR INTERVAL IS 25 FEET.
4. CHANNEL CENTERLINE TAKEN AT APPROXIMATE LOW POINT OF STREAM CHANNEL.
5. SEDIMENT SOURCE LOCATIONS ARE APPROXIMATE AND ARE BASED ON TOPOGRAPHIC MAP AND AERIAL PHOTOGRAPH INTERPRETATION.

N
W E
S

0 4000 8000
Scale in Feet

027-RI-CO-102Q
Coeur d'Alene Basin RI/FS
RI Report

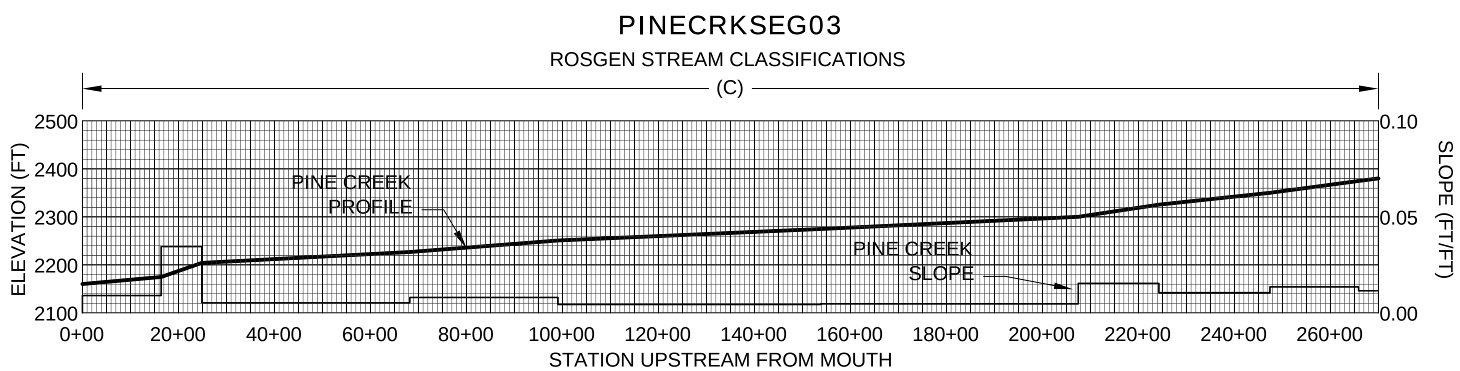
EPA REGION 10

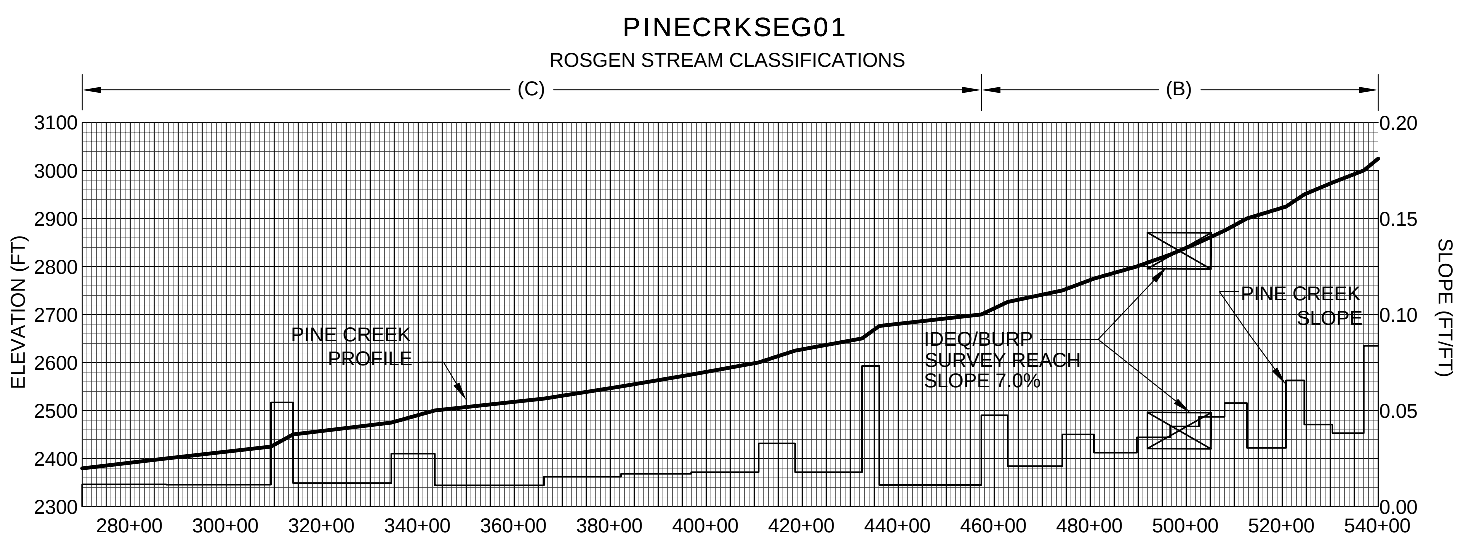
Doc. Control: 4162500.6615.05.a
Generation: 1
Path: N:\Coverages\Others\Shannon&Wilson\\Pine Creek\Pinecreek_Site.dwg
Layout: PineSeg03
07/26/2001

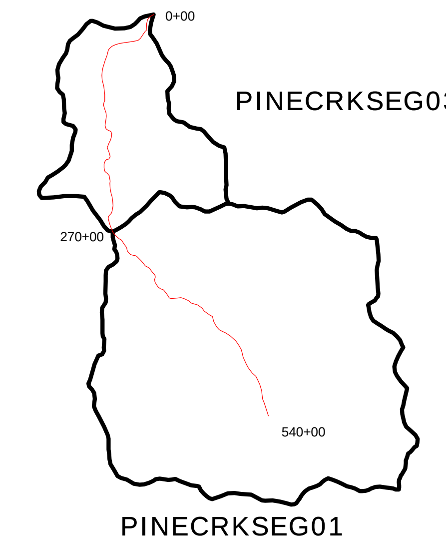
This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: July 26, 2001

Figure 3.2-12
Pine Creek Segment 01 and 03 Section Rosgen Stream Classifications







LEGEND

- SEGMENT PROFILE
- SEGMENT SLOPE
- SEGMENT DRAINAGE AREA (SF)

NOTES:

1. CHANNEL PROFILE AND SLOPES ARE APPROXIMATE AND BASED ON MAP PRODUCED BY AMERICAN DIGITAL CARTOGRAPHY, COPYRIGHT 1995, AND BASED ON 7.5 MINUTE SERIES MAPS, REVISED 1977, ZONE ID-W.
2. VERTICAL DATUM BASED ON NAD83 IDAHO STATE PLANE COORDINATE SYSTEM.
3. DRAINAGE AREAS ARE APPROXIMATE AND MAY NOT BE LINEAR AS INDICATED BY PLOT.

027-RI-CO-102Q
Coeur d'Alene Basin RI/FS
RI Report

EPA
REGION 10

Doc. Control: 4162500.6615.05.05a
Generation: 1
Path: N:\Coverages\Others\Shannon&Wilson\
\Pine Creek\Pine_Section.dwg
Layout: PineCreek
07/20/2000

Table 3.2-1
Historical Estimates of Sediment Transport in Pine Creek Based on Discharge Estimates Derived From Placer Creek and Sediment Transport Data From Pine Creek, Water Year 1999

Year	Sands (tons)	Fines (tons)	Bedload (tons)	Total (tons)
1991	2,294	2,799	4,206	5,093
1992	39	22	388	449
1993	220	170	1,015	1,406
1994	69	46	443	558
1995	847	958	2,043	3,848
1997	4,544	5,463	7,452	17,459
1999	508	418	1,997	2,923
Yearly Average of Sediment Transport				4,738

4.0 NATURE AND EXTENT OF CONTAMINATION

The nature and extent of contamination and mass loading in the three segments of the Pine Creek watershed are discussed in this section. Section 4.1 describes chemical concentrations found in environmental media, including horizontal and vertical extent. For each watershed segment, the discussion includes remedial investigation data chemical analysis results; comparison of chemical results to selected screening levels (Part 1, Section 5.1); and focused analysis of identified source areas. In Section 4.2, preliminary estimates of mass loading are presented.

4.1 NATURE AND EXTENT

The nature and extent of the ten metals of potential concern identified in Part 1, Section 5.1 (antimony, arsenic, cadmium, copper, iron, lead, manganese, mercury, silver, and zinc) in surface soil, subsurface soil, sediment, groundwater and surface water are discussed in this section. Locations with metals detected in any matrix at concentrations 1 times (1x), 10 times (10x) and 100 times (100x) the screening level were identified and presented in the following data summary tables. The magnitudes of exceedence (10x and 100x) were arbitrarily selected to delineate areas of contamination. Metals identified in this evaluation are further evaluated in either the human health or ecological risk assessments (under separate cover).

Historical and recent investigations at areas within the study area are listed and summarized in Part 1, Section 4. Data source references are included as Attachment 1. Chemical data collected in Pine Creek and used in this evaluation are presented at the end of this report. Data summary tables, including sampling location, data source reference, collection date, depth, and reported concentration, are included as Attachment 2. Screening level exceedences are highlighted. Sampling locations are shown on Figures 4.1-1 through 4.1-7.

The nature and extent of contamination were evaluated by screening chemical results against applicable risk-based screening criteria and available background concentrations. Screening levels are used in this analysis to identify source areas and media (e.g., soil, sediment, groundwater, and surface water) of concern that will be evaluated in the feasibility study (FS).

Statistical summaries for each metal in surface soil, subsurface soil, sediment, groundwater, and surface water are included as Attachment 3 and discussed in the subsections below. The summaries include the number of samples analyzed; the number of detections; the minimum and maximum detected concentrations; the average and coefficient of variation; and the screening level (SL) to which the detected concentration is compared. Proposed screening levels were compiled from available federal numeric criteria (e.g., National Ambient Water Quality Criteria), regional preliminary remediation goals (PRGs) (e.g., EPA Region IX PRGs), regional baseline or background studies for soil, sediment, and surface water, and other guidance documents (e.g., Atmospheric Administration freshwater sediment screening values). The screening level selection process is discussed in detail in Part 1, Section 5.1.

Source areas within Pine Creek are presented in Tables 4.1-1 through 4.1-3. These sites are based on source areas initially identified by the BLM (1999) and further refined during the RI/FS process. The tables include source area names, source area ID, source area acres, description, number of samples by matrix type, and metals exceeding 1x, 10x, and 100x the screening levels in surface soil, subsurface soil, sediment, groundwater, and surface water.

It should be noted that the number of samples identified for each source area was determined using the project Geographical Information System. Only sampling locations located within a source area polygon (shown on Figures 4.1-1 through 4.1-7) are included in Tables 4.1-1 through 4.1-3; therefore, there may be samples collected from source areas and listed in the data summary tables in Attachment 2 that are not accounted for in Tables 4.1-1 through 4.1-3.

The following sections present segment-specific sampling efforts and results according to matrix type. Given the extensive geographic range of the Coeur d'Alene Basin, sampling efforts were focused on areas of potential concern; therefore, more samples were collected from known mining-impacted areas near the creek, than from other areas within the watershed.

4.1.1 Segment PineCrkSeg01

4.1.1.1 Surface Soil

Seven surface soil samples were collected from a depth of 0 to 0.5 feet and analyzed for total metals. Antimony, arsenic, copper, lead, and zinc were detected at concentrations in surface soil in excess of 10x the screening levels.

4.1.1.2 Subsurface Soil

Five subsurface soil samples were collected and analyzed for total metals. Lead and zinc exceeded 10x the screening levels at three sampling locations in this segment.

4.1.1.3 Sediment

Fifty-two sediment samples were collected and analyzed for total metals. Arsenic, cadmium, lead, and zinc were detected at concentrations in excess of 10x the screening levels for several sampling locations. The concentration of lead at two locations exceeded 100x the screening level.

4.1.1.4 Groundwater

Seven groundwater samples were collected and analyzed for total metals. Cadmium, copper, manganese, and zinc exceeded 10x the screening levels. The concentration of zinc at three locations exceeded 100x the screening level.

4.1.1.5 Surface Water

One hundred and thirty-one surface water samples were collected and analyzed for total metals in segment PineCrkSeg01. One to many samples showed antimony, cadmium, copper, iron, lead, manganese, and zinc at concentrations in excess of 10x the screening levels. Concentrations of copper, lead, and zinc exceeded 100x the screening levels.

One hundred and seventy-seven samples were collected and analyzed for dissolved metals in segment PineCrkSeg01. One to many samples throughout this segment showed concentrations of antimony, cadmium, copper, iron, lead, manganese, and zinc in excess of 10x the screening levels. Cadmium, copper, lead, manganese, and zinc were also detected in two to many samples in excess of 100x the screening level.

4.1.1.6 Identified Source Areas

Chemical data for surface soil, subsurface soil, sediment, groundwater, and surface water were reviewed together to identify source areas within segment PineCrkSeg01 that may be significant contributors of metals to Pine Creek. Summary source area data are presented in Table 4.1-1.

Twenty-one of the 79 source areas in this segment were sampled. Many of the sampled source areas show concentrations of antimony, arsenic, cadmium, lead, manganese and zinc in excess of 10x the screening levels.

4.1.2 Segment PineCrkSeg02

4.1.2.1 Surface Water

Three surface water samples were collected and analyzed for total metals. Six surface water samples were collected and analyzed for dissolved metals. Total and dissolved metal concentrations in surface water were all less than 10x the screening level.

4.1.2.2 Identified Source Areas

Chemical data for surface soil, subsurface soil, sediment, groundwater, and surface water were reviewed together to identify source areas within segment PineCrkSeg02 that may be significant contributors of metals to Pine Creek. Summary source area data are presented in Table 4.1-2. Thirty source areas are located in this segment. No samples were collected at these sites. No significant source areas were identified in this segment.

4.1.3 Segment PineCrkSeg03

4.1.3.1 Surface Soil

Nine surface soil samples were collected from a depth of 0 to 0.5 feet and analyzed for total metals. Arsenic and lead were detected at concentrations in excess of 10x the screening levels.

4.1.3.2 Subsurface Soil

Six subsurface soil samples were collected and analyzed for total metals in segment PineCrkSeg03. Arsenic, cadmium, lead and zinc were detected at concentrations in excess of 10x the screening levels.

4.1.3.3 Sediment

Twenty-two sediment samples were collected and analyzed for total metals in segment PineCrkSeg03. The concentrations of lead at one location exceeded 10x the screening level.

4.1.3.4 Groundwater

Eight groundwater samples were collected and analyzed for total and dissolved metals. The total copper and zinc concentrations in two samples exceeded 10x the screening levels. These copper concentrations also exceeded 100x the screening level. The dissolved cadmium concentration in one sample exceeded 10x the screening level.

4.1.3.5 Surface Water

One hundred and fifteen surface water samples were collected and analyzed for total metals. One hundred and twenty-one surface water samples were collected and analyzed for dissolved metals. Results for total metals indicate concentrations of copper, lead, and zinc in excess of 10x the screening level. Results for dissolved metals indicate cadmium, lead, and zinc concentrations greater than 10x the screening levels.

4.1.3.6 Identified Source Areas

Chemical data for surface soil, subsurface soil, sediment, groundwater, and surface water were reviewed together to identify source areas within segment PineCrkSeg03 that may be significant contributors of metals to Pine Creek. Summary source area data are presented in Table 4.1-3.

Three of the 22 source areas in this segment were sampled. Concentrations greater than 10x the screening levels for arsenic, cadmium, lead and zinc were detected at the Amy-Matchless Millsite. These concentrations were detected in the surface and subsurface soil.

4.1.4 Adit and Seep Summary

Most adits and seeps with drainage that have been identified and sampled have flows under 1 cfs and relatively low concentrations of metals. However, very high concentrations of total zinc were measured in ten of the adits and four of the seeps identified in the Pine Creek watershed (Gearheart et al. 1999). A total of twenty-one adits and ten seeps were identified. Available adit and seep data for the Pine Creek watershed are summarized in Table 4.1.4-1. Discharge, average total zinc concentration, average total zinc mass loading, and associated source areas are listed. Zinc mass loading from the Sidney (Red Cloud), Nevada-Stewart, and Nabob 1300 Level adits and the Amy-Matchless seep were greater than 1 pound per day. Total zinc mass loading for all adits and seeps identified in the Pine Creek watershed is estimated to be approximately 15 pounds per day.

4.2 SURFACE WATER MASS LOADING

In Part 1 of this report (Setting and Methodology, Section 5.3.1), the concept of mass loading and its use in the remedial investigation was presented. Section 4.2 of the Canyon Creek Nature and Extent further discusses the use of the plotting discrete sampling events versus the probabilistic analysis of the mass loading data in Fate and Transport.

This section presents the discrete mass loading measurements made during several low- and high-flow sampling events. The events were selected to show variations in mass loading throughout the stream system relative to source areas. The events selected are not intended to represent all the available mass loading data. The locations sampled during each event are plotted on a map of the watershed (Figures 4.2-1 through 4.2-6). Each sampling location shows the cumulative mass loading of lead or zinc and the difference in mass lead from the next upstream location. The difference in mass load is indicated on the maps by the term "delta." The remainder of this section presents the indicator metal correlation and selected maps with a discussion of discrete sampling events on a watershed basis.

4.2.1 Indicator Metal Correlation

In Section 4.2 of the Canyon Creek Watershed Nature and Extent, the correlation of chemical concentrations for 8 chemicals of potential concern (COPCs) are evaluated for total lead and dissolved zinc. These two metals appear to be reasonable indicators of the other chemicals of potential concern. The following mass loading discussion is limited to total lead and dissolved zinc.

4.2.2 Pine Creek Watershed Mass Loading

Of the available sampling data, three sampling events were selected and mapped. Table 4.2-1 summarizes the sampling events, sampling locations and calculated mass loads for total lead and dissolved zinc. For consistency and comparison, the same sampling periods were selected as that used in Canyon and Ninemile Creeks. The low-flow events used were November 1997 (Figures 4.2-1 and 4.2-4) and November 1998 (Figures 4.2-2 and 4.2-5). The high flow event used was May 1998 (Figures 4.2-3 and 4.2-6). Data from these sampling events is summarized in Table 4.2-1. The following sections discuss observations made from plotting the low- and high-flow mass loading data.

4.2.2.1 Total Lead Mass Loading

Loading observations are as follows:

As shown on Figures 4.2-1, 4.2-2 and 4.2-3, total lead mass loading at low-flow is low. Mass loading of total lead did not exceed 1 pound per day. Under high-flow conditions lead loading did not exceed 1 pound per day except close to the mouth of Pine Creek. Sample location PC315 had a mass load of 2.5 pounds per day (May 1998). Side streams or tributaries do not appear to contribute substantial load to the main stream system.

4.2.2.2 Dissolved Zinc Mass Loading

Loading observations are as follows:

Under low-flow conditions, zinc loading increases between PC306 and PC312. Sample location PC307 (located in Highland Creek near the mouth) had a zinc load of 29 pounds per day (November 1997). This load may account for the difference in mass load of 34 pounds per day at location PC 312. Between location PC312 and the mouth of Pine Creek, the zinc load decreases. The differences in mass load ranged from -1 to -20 pounds per day.

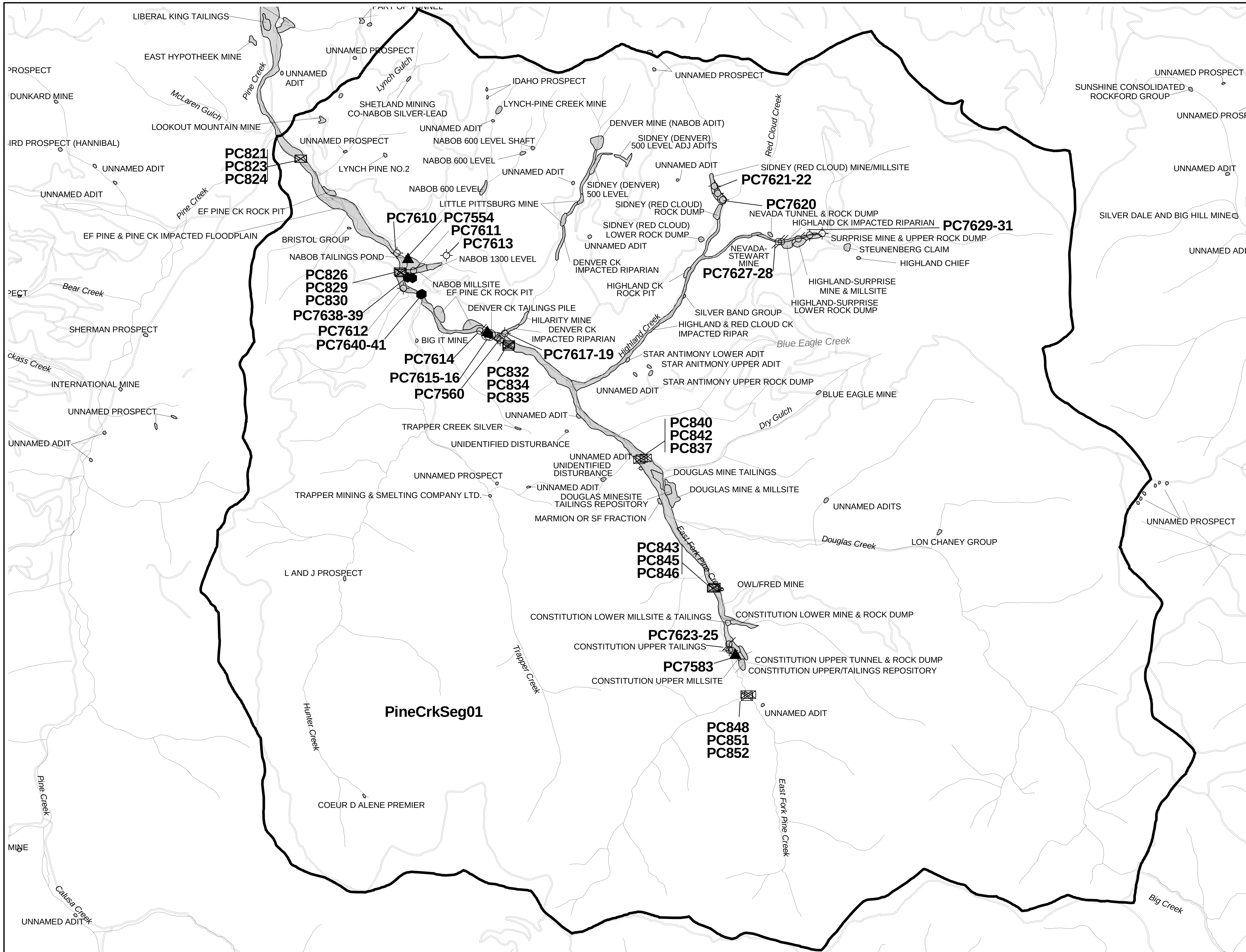
Under high-flow conditions, zinc load increases from PC306 to PC360. Highland Creek adds 31 pounds per day to this increase. PC360 was measured several days prior to other sampling locations, so it is difficult to assess the overall load increase or delta. Between PC339 and the mouth of Pine Creek the load is variable. At PC313, zinc load decreases with a -30 pounds per day difference. At location PC315, closer to the mouth, the difference is -8 pounds per day. The decreases in load may indicate loss of water to the underlying aquifer.

Potential sources include the Constitution Mine Complex, Owl/Fred Mine and Douglas Mine Tailings along Pine Creek and above location PC338. On Highland Creek, the Antimony rock dump and Sidney mine among others could contribute the observed loading. Further downstream, general floodplain waste, the Denver Mine, the Pittsburgh Mine and the Hilarity Mine (mines in Denver Creek) are possible sources. Downstream of PC360, the Nabob Mine, and Denver Creek Tailings, Liberal King Tailings, Matchless Mine are possible sources of loading.

4.2.2.3 Groundwater Mass Loading

The mass loading data does not show a consistent pattern of losing or gaining stream reaches. It is likely that where flood plains are developed, there is an active exchange of metal load with groundwater. A review of groundwater data summarized in Section 4.1 indicates that metal concentrations in many locations exceed the 1 times (1x) screening level, but do not exceed the 10x or 100x screening levels.

Figure 4.1-1
Pine Creek Segment PCSeg01
Source Areas and Soil/Sediment Sampling Locations



LEGEND

- Ground Sampling Location
- Wetlands/Marsh Sampling Location
- Tailings Pile Sampling Location
- Seep Sampling Location
- River Sampling Location
- Test Pit Sampling Location
- Stream
- Road
- City
- Pine Creek Segment 1
- Source Area and Name

Location Map

NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner, Inc., CH2M HILL, and the Bureau of Land Management.

2) Sampling locations obtained from URS Greiner, Inc. Technical Data Management database as of 3/29/00.

SCALE 1:40,000

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N

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Coeur d' Alene Basin RI/FS
RI REPORT

EPA REGION 10

Doc Control 4162500.6615.05a
Generation 1
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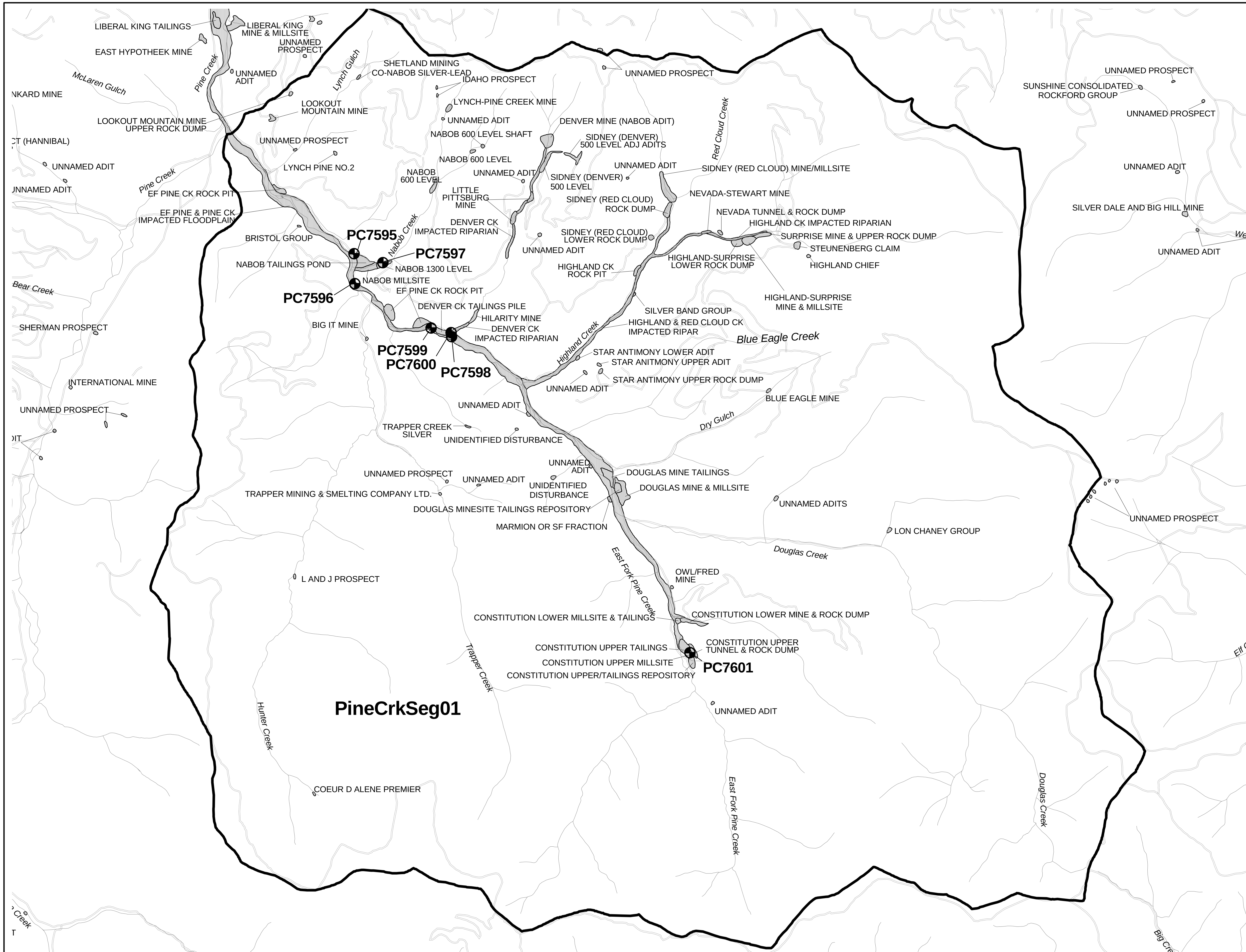
V: PCSeg01Soil 1
E:soil
L: Final RI PCSeg01 Soil1
7/13/2001

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: July 13, 2001

Figure 4.1-2
Pine Creek Segment PineCrkSeg01 Source Areas and Groundwater Sampling Locations



LEGEND

- Monitor Well Sampling Location
- Stream
- Road
- City
- Pine Creek Segment 1
- Source Area and Name

Location Map

NOTES

1) Base map coverages obtained from the Coeur d' Alene Tribe, URS Greiner, Inc., CH2M HILL, and the Bureau of Land Management.

2) Sampling locations obtained from URS Greiner, Inc. Technical Data Management database as of 3/29/00.

SCALE 1:40,000

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Coeur d' Alene Basin RI/FS
RI REPORT

EPA REGION 10

Document Control 4162500.6615.05a
Generation 1
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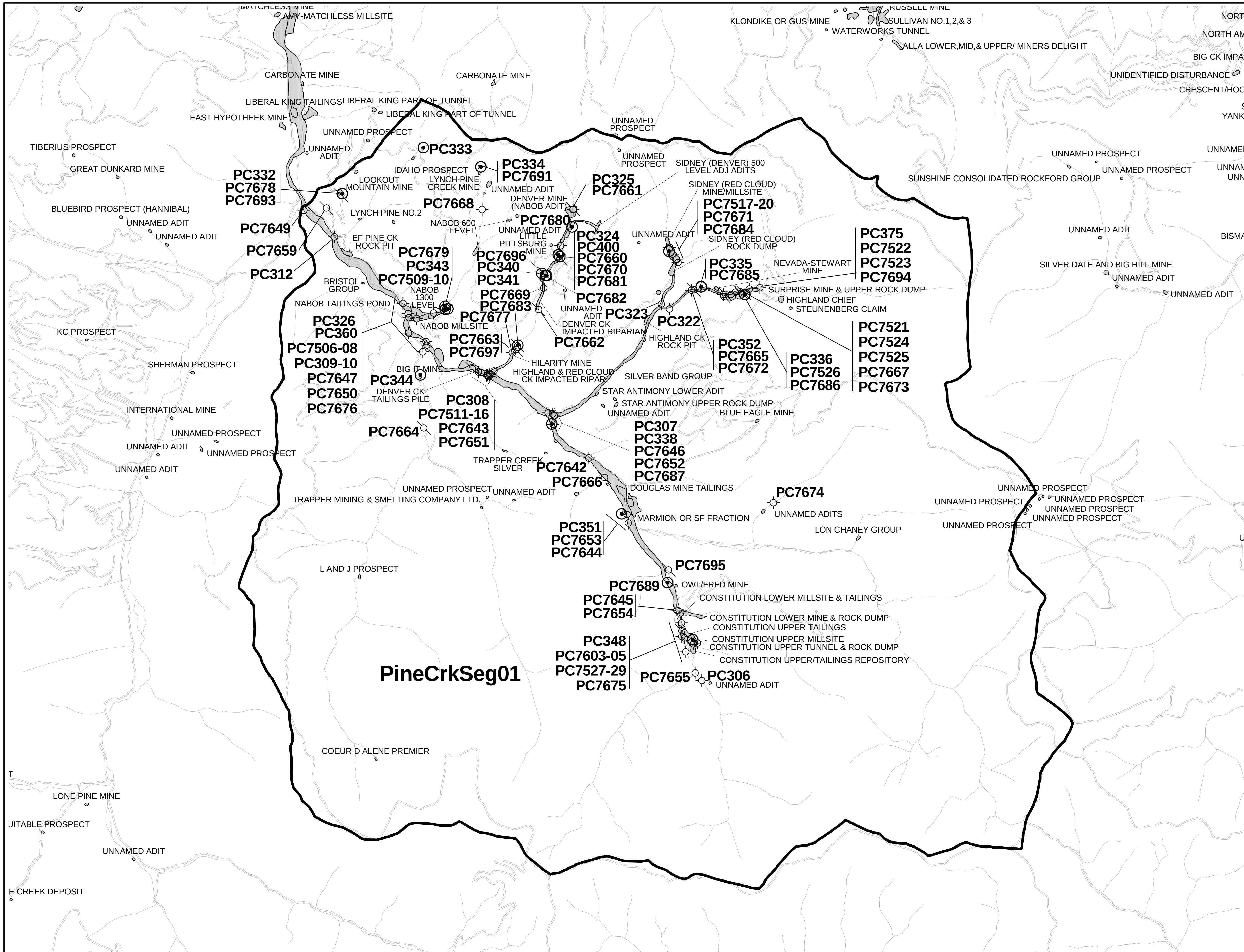
V: PCSeg1 Groundwater
EXTENT:groundwater
LAYOUT: Final RI Pine 1 GW
7/13/2001

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: July 13, 2001

Figure 4.1-3
Pine Creek Segment PCSeg01 Source Areas and Surface Water Sampling Locations



LEGEND

- Adit Sampling Location
- Seep Sampling Location
- River Sampling Location
- Stream
- Road
- City
- Pine Creek Segment 1
- Source Area and Name

Idaho

Location Map

NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner, Inc., CH2M HILL, and the Bureau of Land Management.

2) Sample locations obtained from URS Greiner, Inc. Technical Data Management database as of 3/29/00.

SCALE 1:48,000

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027-RI-CO-102Q
Coeur d' Alene Basin RI/FS
RI REPORT

EPA REGION 10

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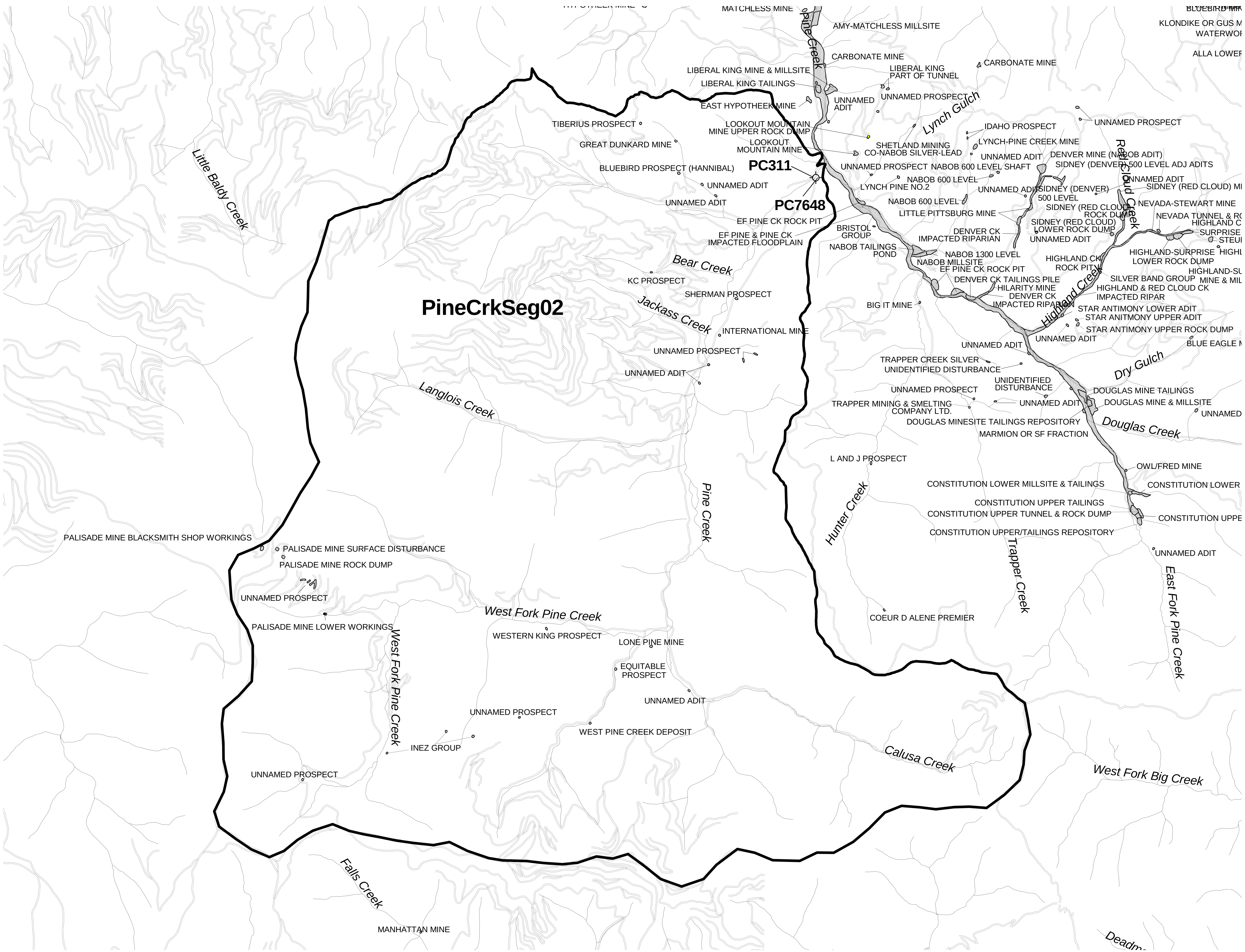
E:SW
L: Final RI PC1SW
7/13/2001

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

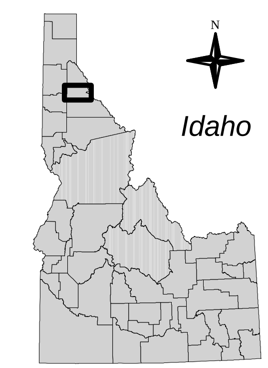
Date of Plot: July 13, 2001

Figure 4.1-4
Pine Creek Segment PCSeg02 Source Areas and Surface Water Sampling Locations



LEGEND

- River Sampling Location
- Stream
- Road
- City
- Pine Creek Segment 2
- Source Area and Name



Location Map

NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner, Inc., CH2M HILL, and the Bureau of Land Management.

2) Sample locations obtained from URS Greiner, Inc. Technical Data Management database as of 3/29/00.

SCALE 1:60,000

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Coeur d' Alene Basin RI/FS
RI REPORT

EPA REGION 10

Document Control 4162500.6615.05a
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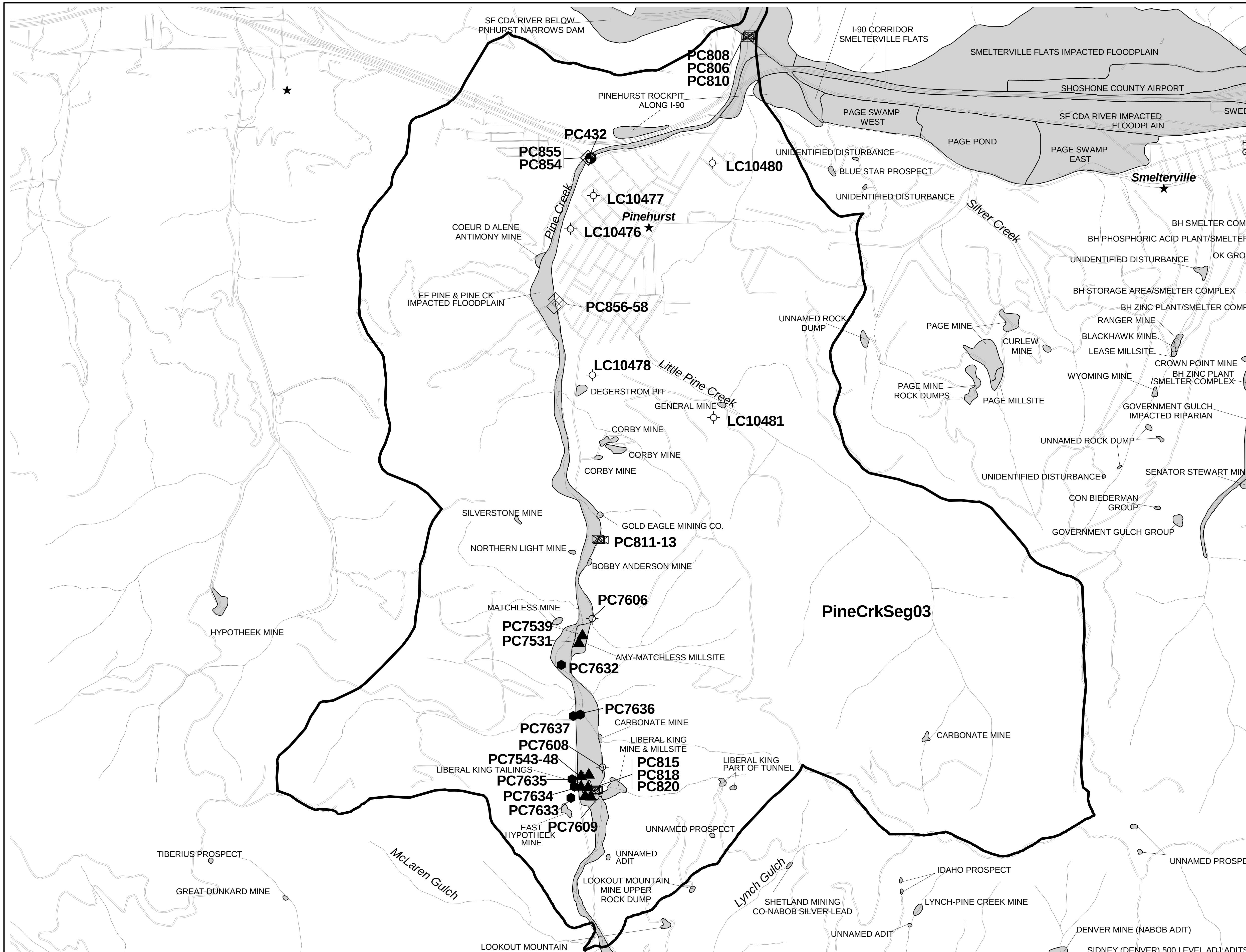
V: PineCrkSeg02
E: surfacewater
L: Final RI PCSeg2 SW
7/13/2001

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: July 13, 2001

Figure 4.1-5
Pine Creek Segment PineCrkSeg03 Source Areas and Soil/Sediment Sampling Locations



LEGEND

- Monitor Well Sampling Location
- Ground Sampling Location
- Waste Rock Sampling Location
- Test Pit Sampling Location
- Tailings Pile Sampling Location
- Hand Auger Sampling Location
- River Sampling Location
- Seep Sampling Location
- Wetlands/Marsh Sampling Location
- Waste Rock Sampling Location
- Stream
- Road
- City
- Pine Creek Segment 3
- Source Area and Name

Location Map

NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner, Inc., CH2M HILL, and the Bureau of Land Management.

2) Sampling Locations from URS Greiner Woodward Clyde Technical Data Management Database as of 10/16/99

SCALE 1:28,000

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Coeur d' Alene Basin RI/FS
RI REPORT

EPA REGION 10

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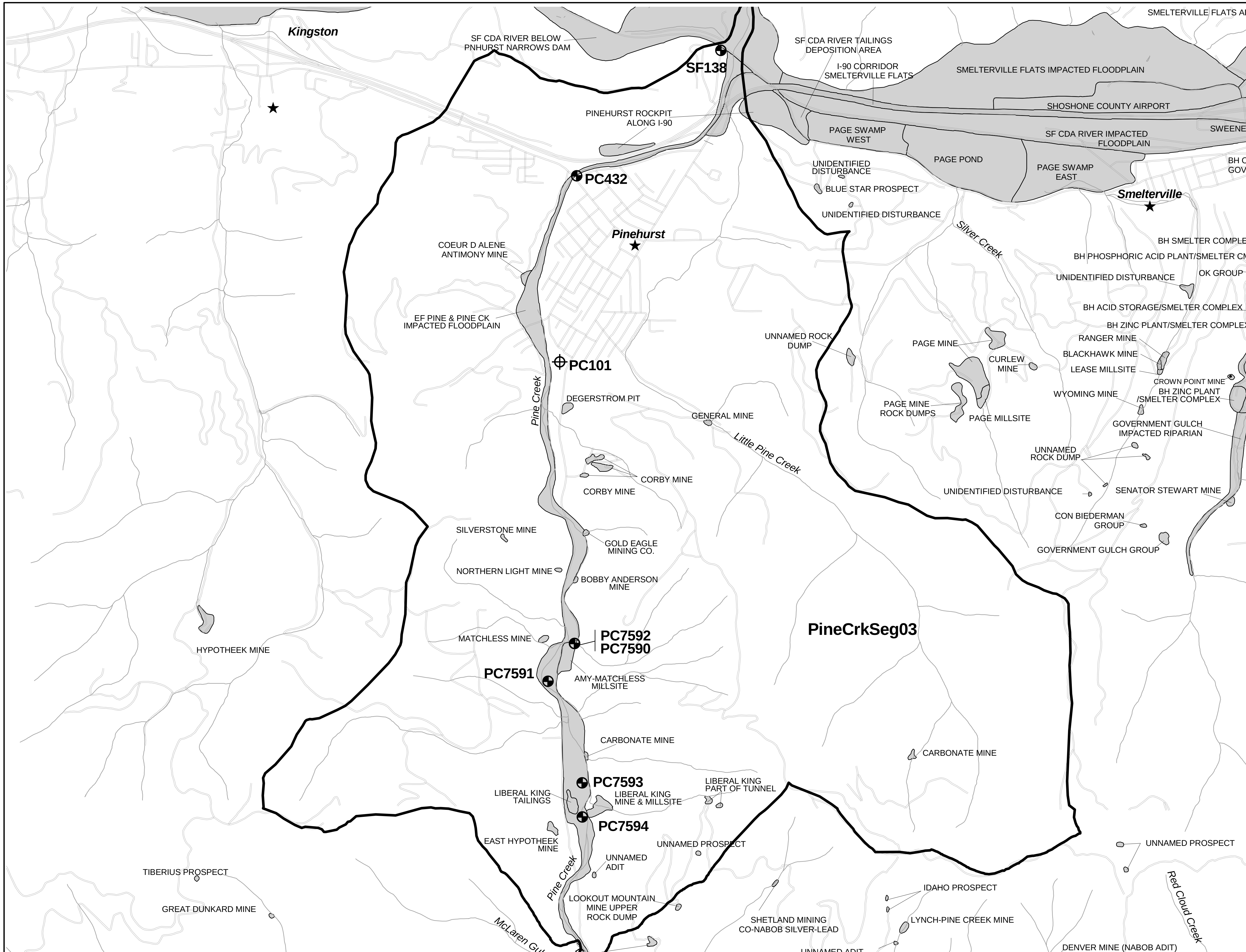
E: soil
L: Final RI PineCkSeg03 Soil
7/13/2001

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: July 13, 2001

Figure 4.1-6
Pine Creek Segment PCSeg03 Source Areas and Groundwater Sampling Locations



LEGEND

- Monitor Well Sampling Location
- Production Well Sampling Location
- Stream
- Road
- City
- Pine Creek Segment 3
- Source Area and Name

Idaho

Location Map

NOTES

1) Base map coverages obtained from the Coeur d' Alene Tribe, URS Greiner, Inc., CH2M HILL, and the Bureau of Land Management.

2) Sampling locations obtained from URS Greiner, Inc. Technical Data Management database as of 3/29/00.

SCALE 1:28,000

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Coeur d' Alene Basin RI/FS
DRAFT RI REPORT

EPA REGION 10

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LAYOUT: PineCrk Seg3 Groundwater
5/16/2000

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: MAY 16, 2000

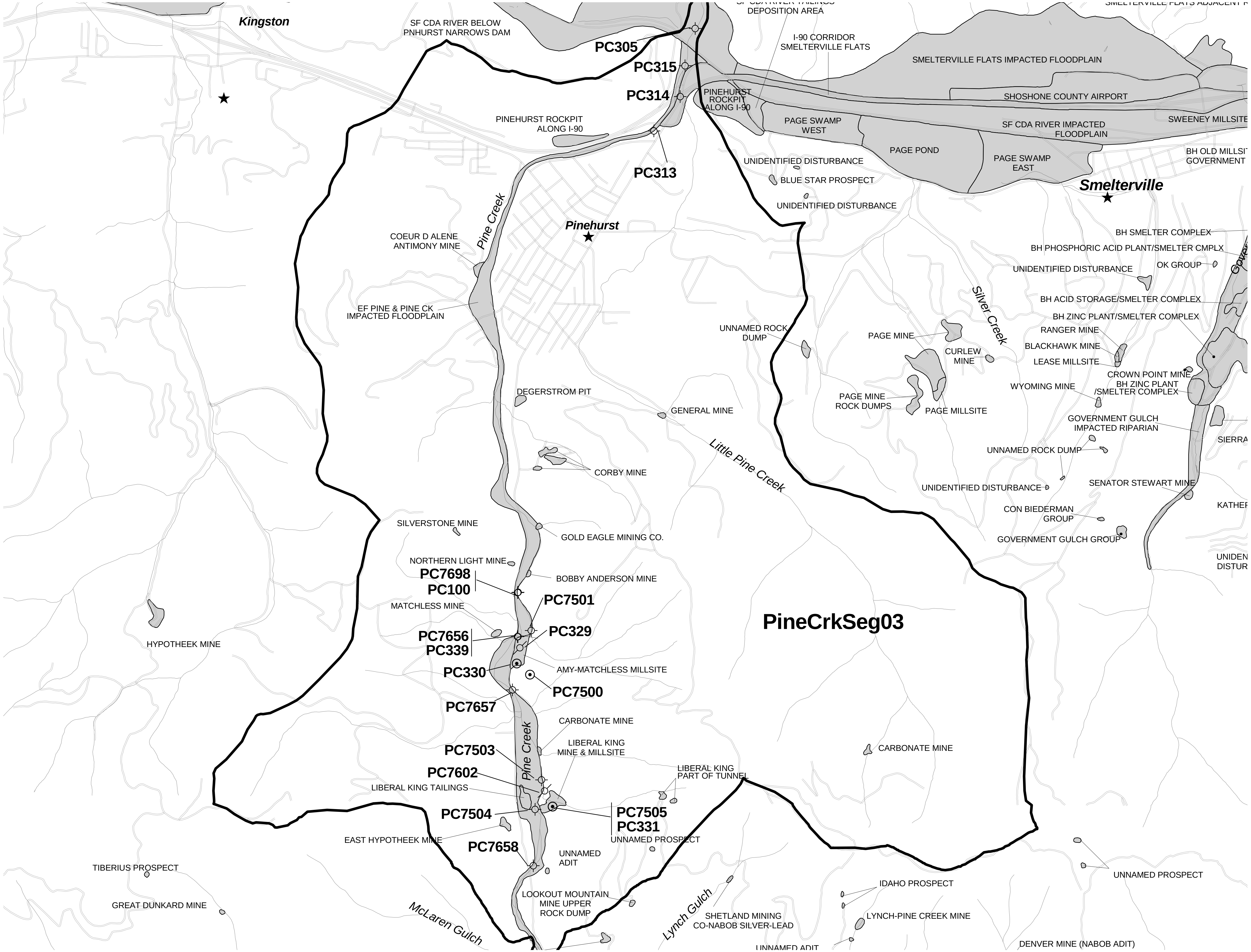
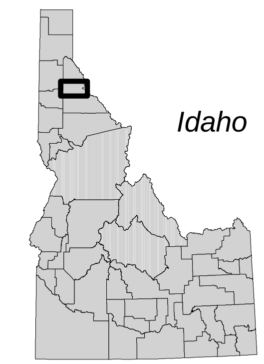


Figure 4.1-7
Pine Creek Segment PineCrkSeg03 Source Areas and Surface Water Sampling Locations

LEGEND

- Adit Sampling Location
- Seep Sampling Location
- River Sampling Location
- Stream
- Road
- City
- Pine Creek Segment 3
- Source Area and Name



NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner, Inc., CH2M HILL, and the Bureau of Land Management.

2) Sample locations obtained from URS Greiner, Inc. Technical Data Management database as of 3/29/00.

SCALE 1:28,000

0 0.5 Miles

027-RI-CO-102Q
Coeur d' Alene Basin RI/FS
RI REPORT

EPA REGION 10

Document Control 4162500.6615.05a
Generation 1
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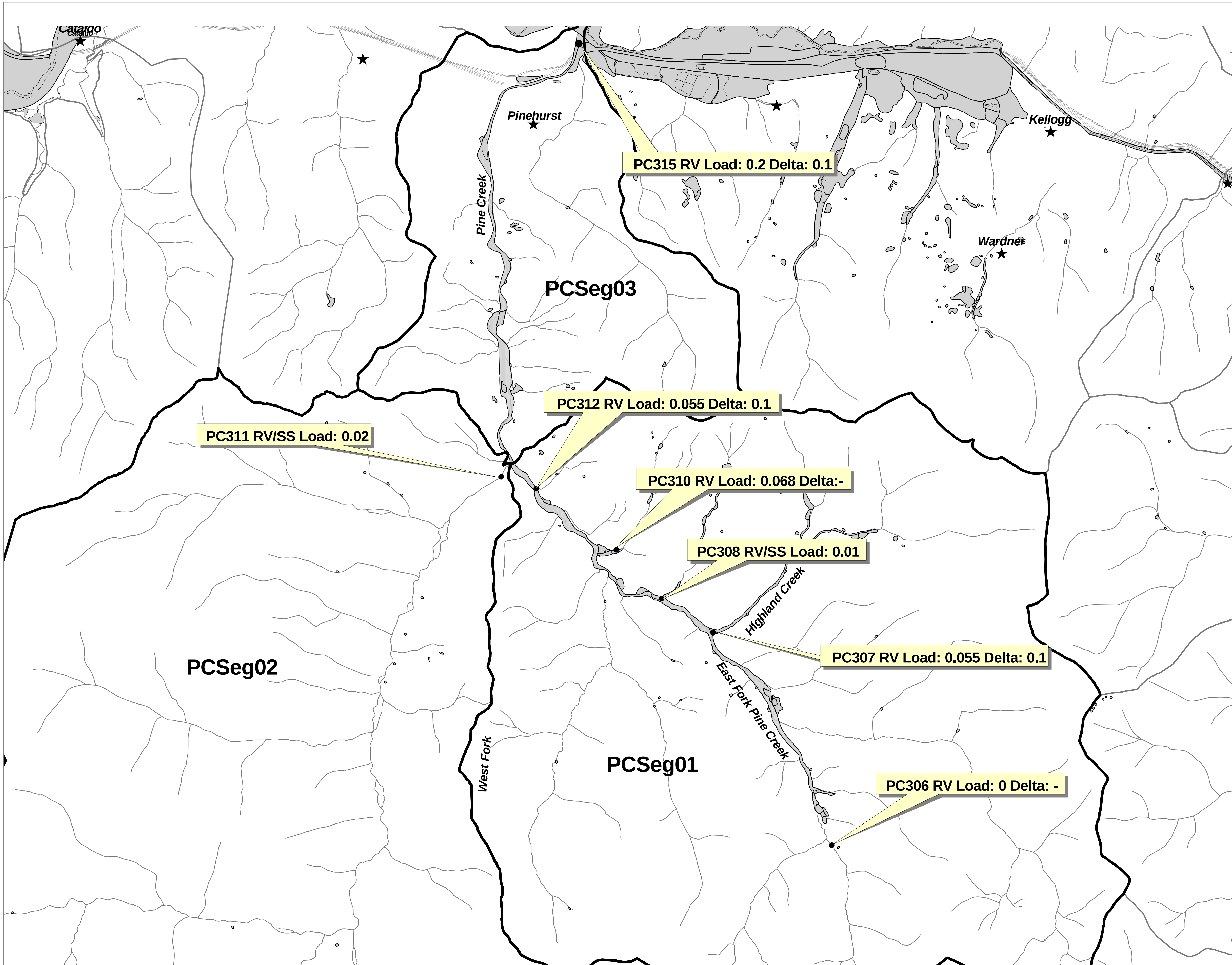
E: Surfacewater
L: Final RI PineCkSeg03 Surface Water
7/13/2001

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: MAY 16, 2000

Figure 4.2-1
Pine Creek Watershed
Total Lead Mass Loading
Sampling Results from November 1997



LEGEND

Sampling Location

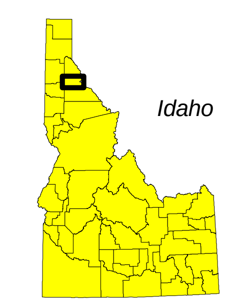
PC315 RV Load: 33 Delta: -1

Location Type:
RV:River/Stream Sampling Location
AD: Adit Sampling Location
SP: Seep Samling Location
OF: Outfall Sampling Location
SS: Side Stream Sampling Location

(-) Neg. (+) Pos. Delta of Mass Load Compared to Preceeding Upstream Sampling Location

Delta Range: 0 - 20
Delta Range: 20 - 40
Delta Range: 40 - 100
Delta Range: 100 - 150
Delta Range: > 150

Stream
Road
Interstate 90
City
Pine Creek Watershed
Pine Creek Segment
River Segment
Lake/River
Source Area



Location Map

NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.

SCALE 1: 60,000

0.5 0 0.5 Miles

027-RI-C0-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

EPA REGION 10

Document Control 4162500.6615.05a
Generation 1
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pine creek massloading 7-12-00.apr
V:dPb Pine Creek Nov 98
E:Pine Creek
L: Final RI dPb Mass Loading Nov-97
7/16/2001

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: July 16, 2001

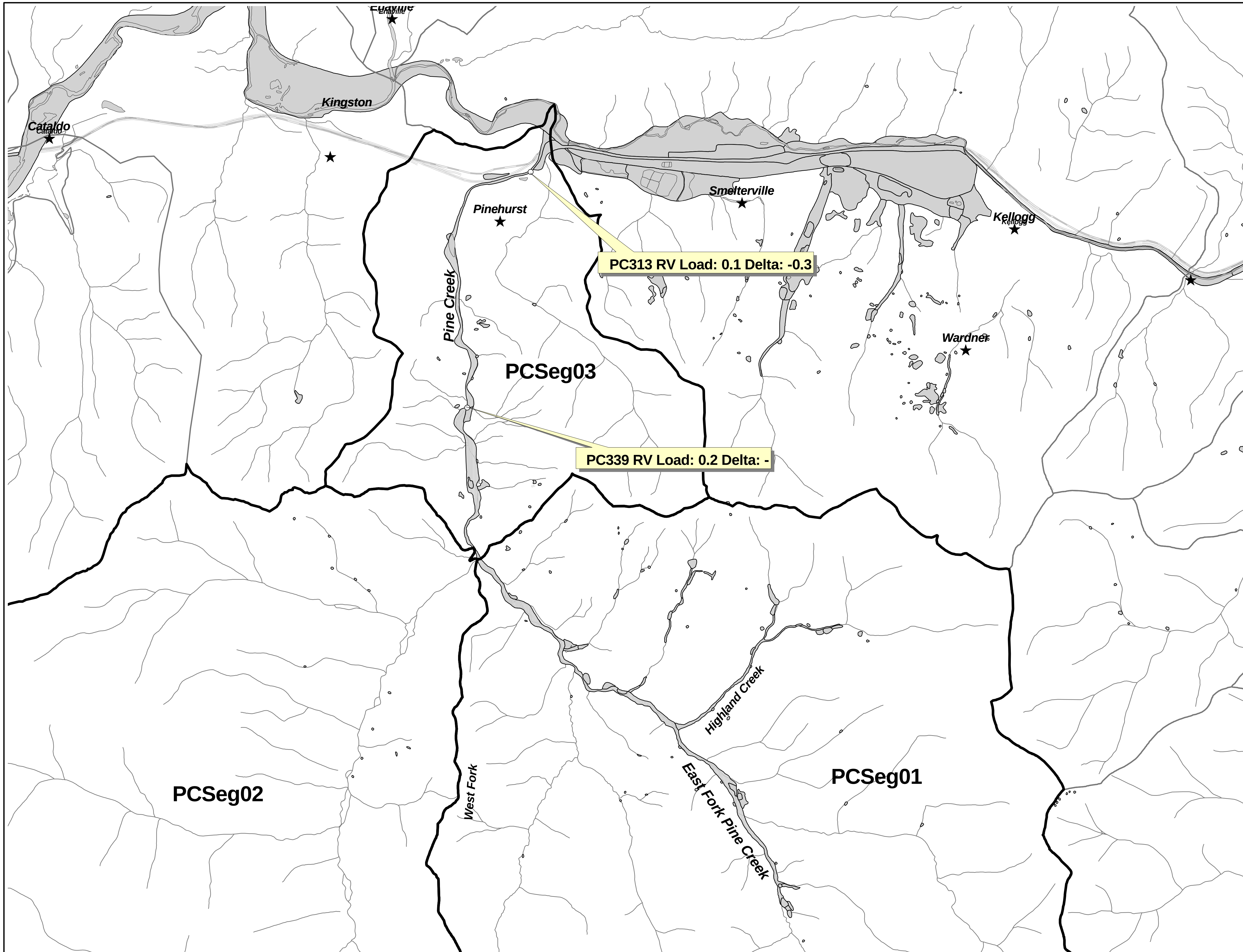


Figure 4.2-2
Pine Creek Watershed
Total Lead Mass Loading
Sampling Results from November 1998

Sampling Location

LEGEND

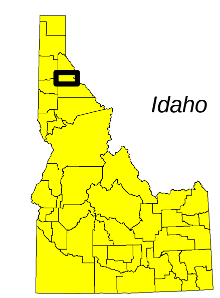
PC313 RV Load: 0.07 Delta: -0.3

Location Type:
RV:River/Stream Sampling Location
AD: Adit Sampling Location
SP: Seep Samling Location
OF: Outfall Sampling Location
SS: Side Stream Sampling Location

(-) Neg. (+) Pos. Delta of Mass Load Compared to Preceeding Upstream Sampling Location

Delta Range: 0 - .9
Delta Range: 1 - 20
Delta Range: 20 - 40
Delta Range: 40 - 100
Delta Range: 100 - 150
Delta Range: > 150

Stream
Interstate 90
City
Pine Creek Watershed
Pine Creek Segment
River Segment
Source Area



Location Map

NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.

SCALE 1: 60,000

0.5 0 0.5 Miles

N

027-RI-C0-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

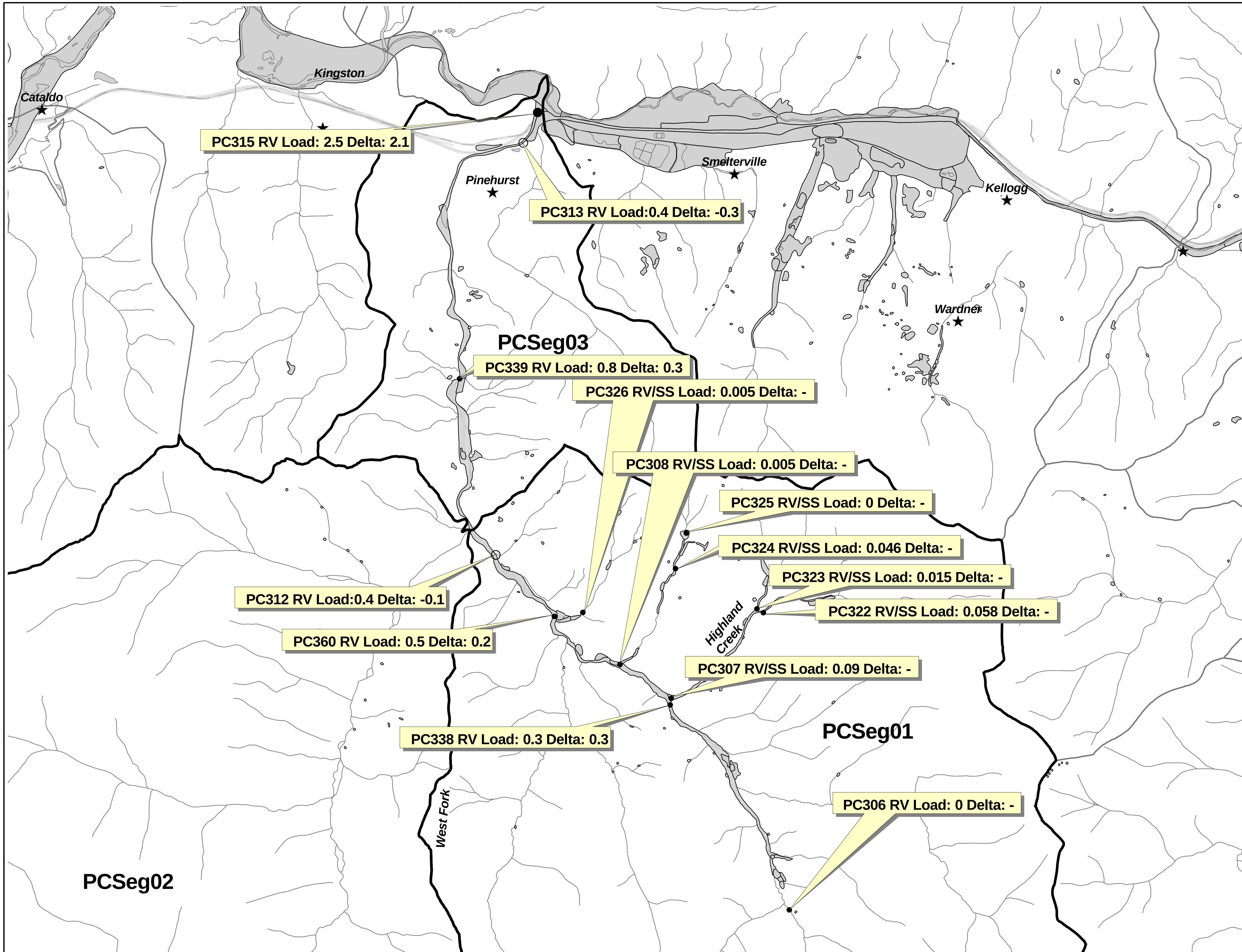
EPA REGION 10

Document Control 4162500.6615.05a
Generation 1
n:\Projects\watersheds\pone-strshd
pinecreek mass loading 7-12-00.apr
V TPB PINE CREEK Nov98
E PINE CREEK
L: Final RI tPB Pine Creek Nov 98
7/16/2001

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: July 16, 2001

Figure 4.2-3
Pine Creek Watershed
Total Lead Mass Loading
Sampling Results from May 1998



LEGEND

Sampling Location

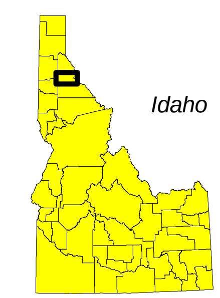
PC315 RV Load: 2.5 Delta: 2.1

Location Type:
RV:River/Stream Sampling Location
AD: Adit Sampling Location
SP: Seep Samling Location
OF: Outfall Sampling Location
SS: Side Stream Sampling Location

(-) Neg. (+) Pos. Delta of Mass Load Compared to Preceeding Upstream Sampling Location

Delta Range: 0 - .9
Delta Range: 1 - 20
Delta Range: 20 - 40
Delta Range: 40 - 100
Delta Range: 100 - 150
Delta Range: > 150

Stream
Interstate 90
City
Pine Creek Watershed
Pine Creek Segment
River Segment
Source Area



Location Map

NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.

SCALE 1: 60,000
0.5 0 0.5 Miles

N

027-RI-C0-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

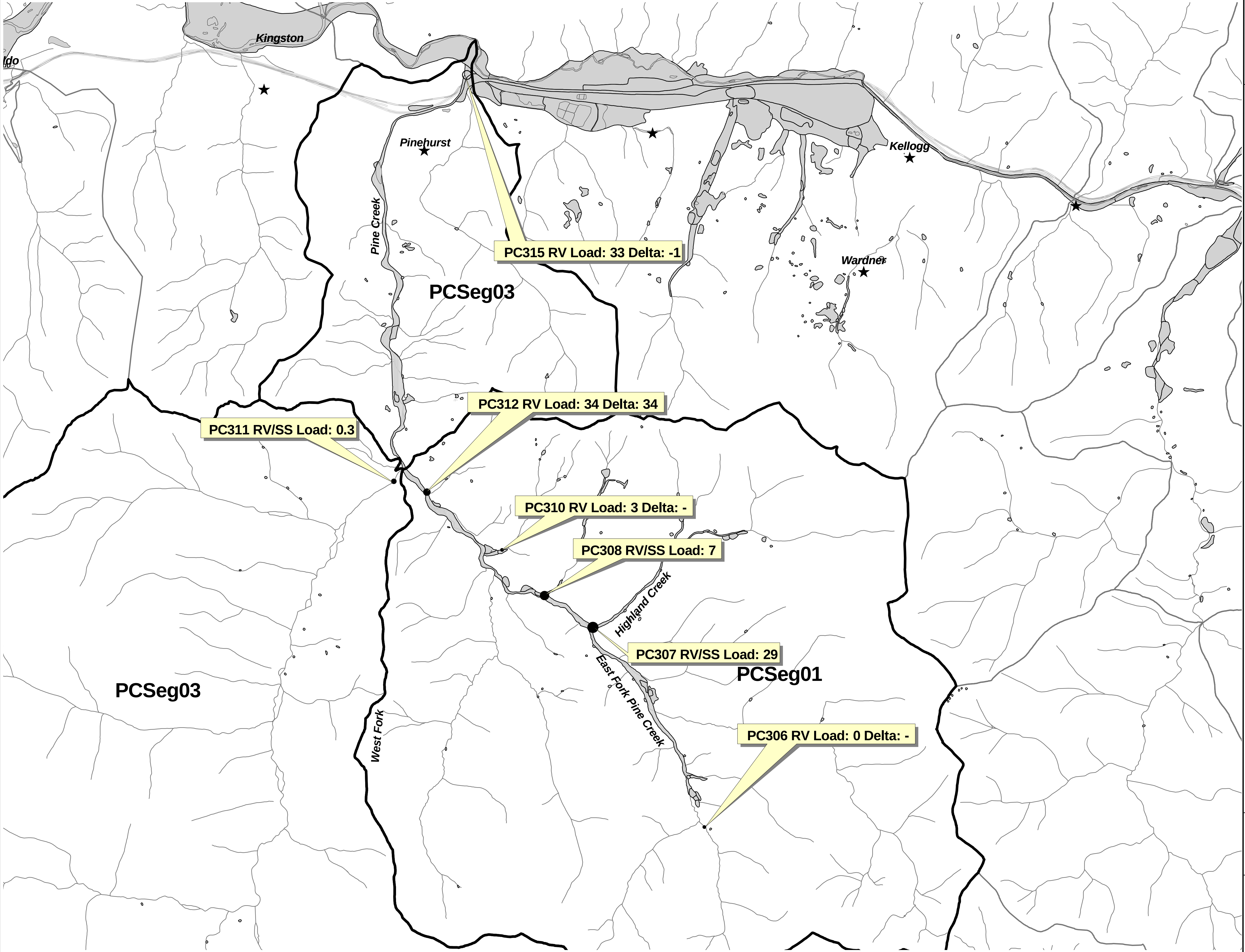
EPA REGION 10

Document Control 4162500.6615.05a
Generation 1
n:\Projects\watersheds\pine-wtrshd
pinecreek mass loading 7-12-00.apr
V TPB PINE CREEK MAY 98
E PINE CREEK
L: Final RI tPB Mass Load May 98
7/16/2001

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: July 16, 2001

Figure 4.2-4
Pine Creek Watershed
Dissolved Zinc Mass Loading
Sampling Results from November 1997



LEGEND

Sampling Location

PC315 RV Load: 33 Delta: -1

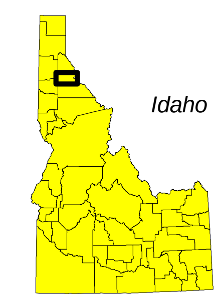
Location Type:

RV:River/Stream Sampling Location
AD: Adit Sampling Location
SP: Seep Samling Location
OF: Outfall Sampling Location
SS: Side Stream Sampling Location

(-) Neg. (+) Pos. Delta of Mass Load Compared to Preceeding Upstream Sampling Location

- Delta Range: 0 - 20
- Delta Range: 20 - 40
- Delta Range: 40 - 100
- Delta Range: 100 - 150
- Delta Range: > 150

Stream
Road
Interstate 90
City
Pine Creek Watershed
Pine Creek Segment
River Segment
Lake/River
Source Area



Location Map

NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.

SCALE 1: 60,000

0.5 0 0.5 Miles

N

027-RI-C0-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

EPA REGION 10

Document Control 4162500.6615.05a
Generation 1
n:\Projects\watersheds\Pine-wtrshd\
pine creek massloading 7-12-00.apr
V:dZn Pine Creek Nov 98
E:Pine Creek
L: Final RI dZn Mass Loading Nov-97
7/16/2001

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: July 16, 2001

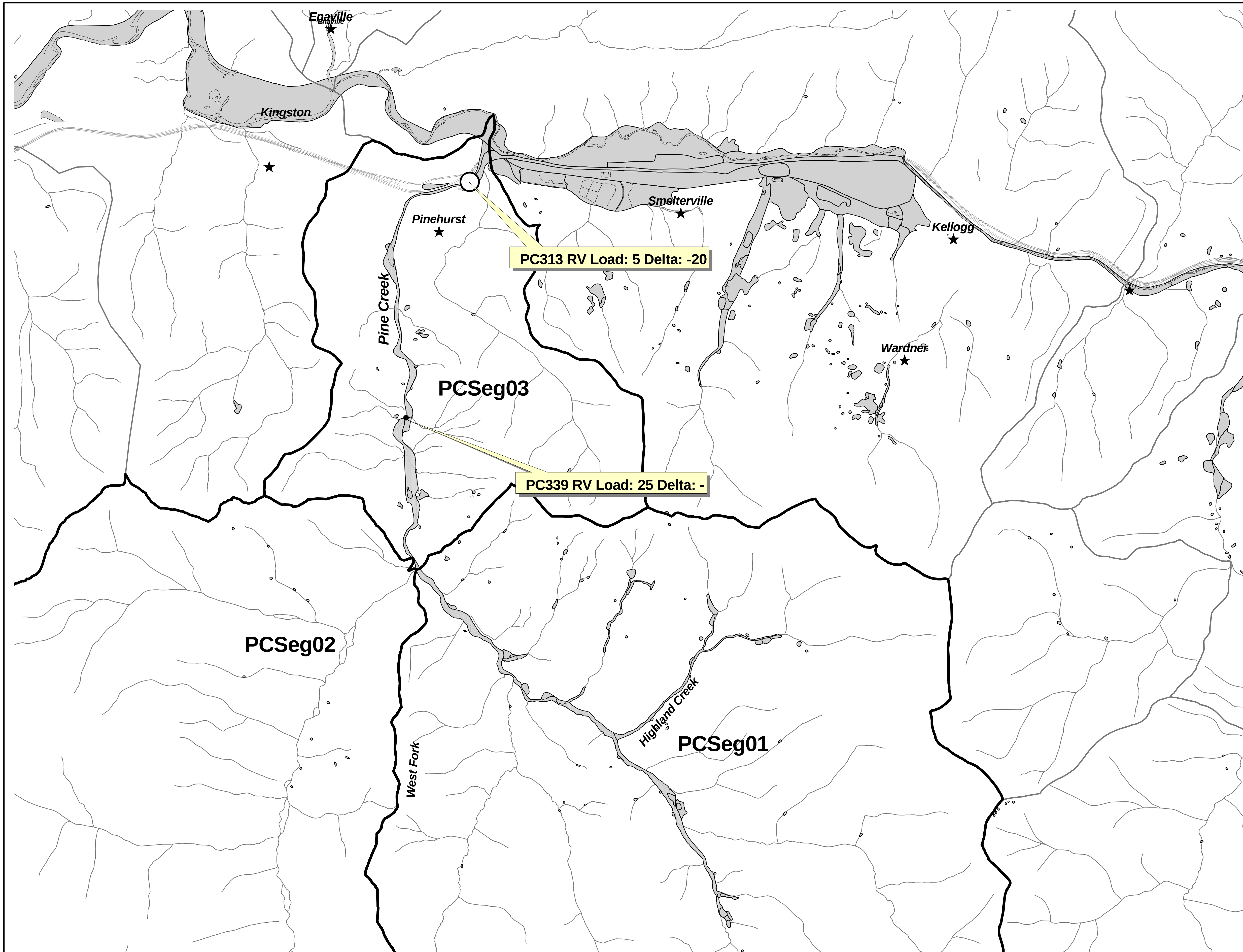


Figure 4.2-5
Pine Creek Watershed
Dissolved Zinc Mass Loading
Sampling Results from November 1998

LEGEND

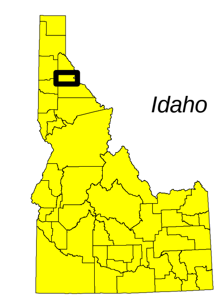
Sampling Location

PC313 RV Load: 5 Delta: -20

Location Type:
RV:River/Stream Sampling Location
AD: Adit Sampling Location
SP: Seep Samling Location
OF: Outfall Sampling Location
SS: Side Stream Sampling Location

(-) Neg. (+) Pos. Delta of Mass Load Compared to Preceeding Upstream Sampling Location
- Delta Range: 0 - 20
- Delta Range: 20 - 40
- Delta Range: 40 - 100
- Delta Range: 100 - 150
- Delta Range: > 150

Stream
Road
Interstate 90
City
Pine Creek Watershed
Pine Creek Segment
River Segment
Lake/River
Source Area



Location Map

NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.

SCALE 1: 60,000

0.5 0 0.5 Miles

N

027-RI-C0-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

EPA REGION 10

Document Control 4162500.6615.05a
Generation 1
n:\Projects\watersheds\Pine-wtrshd\
pine creek massloading 7-12-00.apr
V:dZn PC Mass Load Nov 98
E:Pine Creek
L: Final RI dZn PC Mass Load Nov-98
7/16/2001

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: July 16, 2001

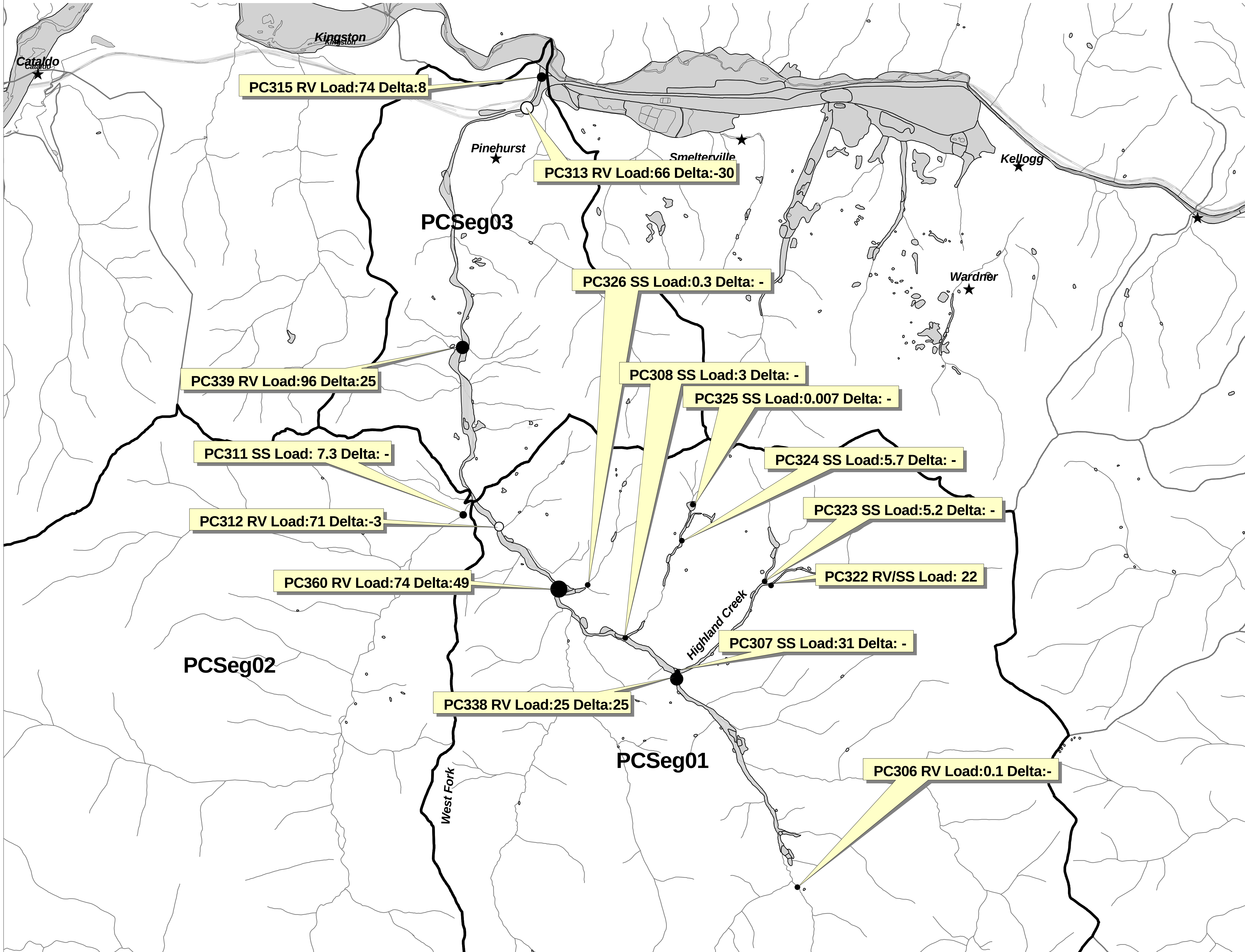


Figure 4.2-6
Pine Creek Watershed
Dissolved Zinc Mass Loading
Sampling Results May 1998

Sampling Location

PC315 RV Load: 2.5 Delta: 2.1

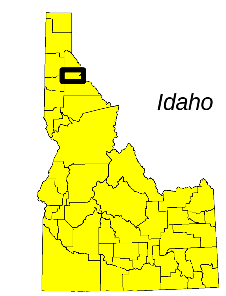
Location Type:

RV:River/Stream Sampling Location
AD: Adit Sampling Location
SP: Seep Samling Location
OF: Outfall Sampling Location
SS: Side Stream Sampling Location

(-) Neg. (+) Pos. Delta of Mass Load Compared to Preceeding Upstream Sampling Location

Delta Range: 0 - .9
Delta Range: 1 - 20
Delta Range: 20 - 40
Delta Range: 40 - 100
Delta Range: 100 - 150
Delta Range: > 150

Stream
Interstate 90
City
Pine Creek Watershed
Pine Creek Segment
River Segment
Source Area



Location Map

NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.

SCALE 1: 60,000

0.5 0 0.5 Miles

N

027-RI-C0-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

EPA REGION 10

Document Control 4162500.6615.05.a
Generation 1
n:\Projects\watersheds\pine-wtrshd
pinecreek mass loading 7-12-00.apr
V Zn May98
E PINE CREEK
L Final RI dZn PC May98
8/16/2001

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: August 16, 2001

Table 4.1-1
Potential Source Areas Within Pine Creek - segment PineCrkSeg01

Source Area Name	Source ID	Area (Acres)	Source Description	No. Samples By Matrix Type		Metals > 1X	Metals > 10X	Metals > 100X
BIG IT MINE	MAS029	0.22	Adit drainage Upland waste rock (intermixed tailings)	SW	1		SWD: Sb-1 SWT: Sb-1	
BLUE EAGLE MINE	MAS023	0.35	Upland waste rock (erosion potential)					
BRISTOL GROUP	MAS034	0.15	Upland waste rock					
COEUR D ALENE PREMIER	MAS033	0.20	Upland waste rock (erosion potential)					
CONSTITUTION LOWER MILLSITE & TAILINGS	MAS048	0.68	Floodplain tailings Upland tailings					
CONSTITUTION LOWER MINE & ROCK DUMP	MAS027	2.42	Floodplain waste rock					
CONSTITUTION UPPER MILLSITE (BLM land)	MAS026	1.25	Floodplain tailings Seep	GW SW	1 1	GWT: Cd-1, Cu-1, Fe-1 SWT: Cu-1, Pb-1, Zn-1	GWT: Mn-1	GWT: Zn-1
CONSTITUTION UPPER TAILINGS (non-BLM land)	MAS049	2.93	Floodplain tailings Seep	SB SD SS SW	2 2 1 1	SBT: Cd-1, Pb-1 SDT: Ag-2, As-2, Cd-2, Cu-2, Hg-2, Mn-2, Sb-2 SST: As-1, Cd-1 SWT: Cu-1, Pb-1, Zn-1	SBT: Pb-1, Zn-2 SDT: Pb-2, Zn-2 SST: Pb-1, Zn-1	
CONSTITUTION UPPER TUNNEL & ROCK DUMP	MAS050	1.50	Adit drainage Floodplain waste rock (intermixed tailings)	SW	3	SWD: Cd-1, Pb-2, Zn-2 SWT: Zn-3		
CONSTITUTION UPPER/TAILINGS REPOSITORY	MAS085	1.59	Floodplain tailings					
DENVER CK IMPACTED RIPARIAN: NO. 1	MAS043	3.11	Floodplain sediments					
DENVER CK IMPACTED RIPARIAN: NO. 2	MAS040	1.43	Floodplain sediments	SD SW	1 1	SDT: As-1, Hg-1, Zn-1 SWT: Cd-1	SDT: Pb-1	SWT: Zn-1
DENVER CK IMPACTED RIPARIAN: NO. 3	MAS041	2.43	Floodplain sediments	SW	1		SWD: Cd-1, Pb-1, Zn-1	
DENVER CK IMPACTED RIPARIAN: NO. 4	MAS042	1.13	Floodplain sediments					
DENVER CK TAILINGS PILE	MAS036	1.87	Floodplain tailings Seep	SB SD SS SW	2 2 1 2	SBT: As-2, Cd-1, Cu-1, Pb-1, Zn-1 SDT: As-2, Cd-1, Cu-2, Hg-1, Zn-1 SST: As-1, Cu-1, Zn-1 SWT: Cd-2, Cu-1	SBT: Pb-1, Zn-1 SDT: Pb-2, Zn-1 SST: Pb-1 SWT: Cu-1, Fe-1, Mn-1, Pb-1, Zn-1	SWT: Zn-1
DENVER MINE (NABOB ADIT)	MAS018	3.77	Upland waste rock (erosion potential)	SW	2	SWD: Fe-1	SWD: Mn-1	
DOUGLAS MINE & MILLSITE	MAS025	5.02	Floodplain waste rock (intermixed tailings)					
DOUGLAS MINE TAILINGS	MAS024	3.01	Floodplain tailings					

Table 4.1-1
Potential Source Areas Within Pine Creek - segment PineCrkSeg01

Source Area Name	Source ID	Area (Acres)	Source Description	No. Samples By Matrix Type		Metals > 1X	Metals > 10X	Metals > 100X
DOUGLAS MINESITE TAILINGS REPOSITORY	MAS084	1.63	Floodplain tailings					
EF PINE & PINE CK IMPACTED FLOODPLAIN (PineCrkSeg01 & PineCrkSeg03)	MAS047	134.30	Floodplain sediments Floodplain sediments	GW SB SD SS SW	7 2 45 4 110	GWT: Cd-2, Cu-7, Mn-2, Sb-2, Zn-4 SBT: As-2, Cd-1, Cu-1, Pb-2, Zn-1 SDT: Ag-2, As-22, Cd-25, Cu-11, Fe-1, Hg-4, Pb-27, Sb-2, Zn-41 SST: As-3, Pb-3, Zn-4 SWD: Cd-8, Cu-6, Fe-2, Mn-2, Pb-48, Sb-2, Zn-42 SWT: Cd-32, Cu-2, Fe-3, Mn-1, Pb-8, Zn-24	GWT: Zn-2 SDT: As-1, Cd-1, Pb-14, Zn-1 SST: As-1, Pb-1 SWD: Cd-34, Mn-1, Pb-3, Zn-27 SWT: Zn-10	GWT: Zn-1 SDT: Pb-1 SWD: Zn-17 SWT: Zn-27
EF PINE CK ROCK PIT: NO. 1	MAS039	3.05	Floodplain waste rock					
EF PINE CK ROCK PIT: NO. 2	MAS038	3.43	Floodplain waste rock					
EF PINE CK ROCK PIT: NO. 3	MAS037	1.58	Floodplain waste rock					
HIGHLAND & RED CLOUD CK IMPACTED RIPAR	MAS046	24.61	Floodplain sediments	SW	40	SWD: Cd-37, Mn-1, Pb-24 SWT: Cd-30, Pb-1	SWD: Cd-1, Zn-40 SWT: Zn-35	
HIGHLAND CHIEF	MAS060	0.27	Upland waste rock					
HIGHLAND CK IMPACTED RIPARIAN	MAS045	3.10	Floodplain sediments Floodplain sediments	SD SW	4 5	SDT: Cd-3, Cu-4, Hg-3, Mn-1, Sb-1, Zn-1 SWD: Pb-1 SWT: Cu-3, Mn-1, Pb-3, Zn-1	SDT: As-4, Pb-3, Zn-3 SWD: Zn-1 SWT: Cd-2, Zn-1	SDT: Pb-1 SWT: Zn-2
HIGHLAND CK ROCK PIT	MAS044	0.92	Floodplain waste rock					
HIGHLAND-SURPRISE LOWER ROCK DUMP	MAS079	1.90	Floodplain waste rock	SW	1	SWD: Cu-1, Mn-1	SWD: Cd-1, Pb-1	SWD: Zn-1
HIGHLAND-SURPRISE MINE & MILLSITE	MAS078	2.51	Adit drainage Seep Upland tailings Upland tailings Upland waste rock	SW	6	SWD: Cd-3, Cu-1, Mn-3, Pb-1 SWT: Cd-4, Cu-4, Fe-2, Mn-4, Pb-1	SWD: Cd-1, Mn-2, Pb-1, Zn-4 SWT: Zn-3	SWD: Zn-1 SWT: Zn-1
HILARITY MINE	MAS014	1.28	Adit drainage Seep Upland tailings Upland waste rock					
IDAHO PROSPECT: NO. 1	MAS010	0.16	Upland waste rock					
IDAHO PROSPECT: NO. 2	MAS011	0.15	Adit drainage Upland waste rock	SW	1	SWT: Fe-1	SWD: Cd-1, Mn-1 SWT: Cd-1, Mn-1, Pb-1	SWD: Cu-1, Pb-1, Zn-1 SWT: Cu-1, Zn-1
L AND J PROSPECT	MAS032	0.27	Upland waste rock (erosion potential)					

Table 4.1-1
Potential Source Areas Within Pine Creek - segment PineCrkSeg01

Source Area Name	Source ID	Area (Acres)	Source Description	No. Samples By Matrix Type		Metals > 1X	Metals > 10X	Metals > 100X
LITTLE PITTSBURG MINE: NO. 1	MAS016	0.97	Adit drainage Upland waste rock (erosion potential)	SW	5	SWD: Cu-2, Fe-1 SWT: Fe-1	SWD: Cd-1, Cu-1, Fe-1, Mn-2, Pb-1, Zn-1 SWT: Cd-3, Cu-2, Fe-1, Mn-3	SWD: Cd-2, Mn-2, Pb-1, Zn-3 SWT: Cu-1, Pb-1, Zn-3
LITTLE PITTSBURG MINE: NO. 2	MAS015	1.51	Adit drainage Seep Upland waste rock (erosion potential)	SW	3	SWD: Cd-3, Pb-2, Zn-2 SWT: Cu-1, Pb-1, Zn-2	SWD: Zn-1	
LON CHANEY GROUP	MAS028	0.45	Upland waste rock (erosion potential)					
LOOKOUT MOUNTAIN MINE	MAS004	0.85	Adit drainage Upland waste rock	SW	3	SWD: Cd-2, Cu-2, Zn-2 SWT: Cu-2, Zn-2		
LOOKOUT MOUNTAIN MINE UPPER ROCK DUMP	MAS067	0.36	Seep Upland waste rock					
LYNCH PINE NO.2	MAS005	0.29	Upland waste rock					
LYNCH-PINE CREEK MINE	MAS012	0.93	Adit drainage Upland waste rock (erosion potential)					
MARMION OR SF FRACTION	MAS054	0.44	Adit drainage Floodplain waste rock	SW	1	SWD: Cd-1, Mn-1, Pb-1, Zn-1 SWT: Fe-1, Mn-1	SWT: Zn-1	
NABOB 1300 LEVEL	MAS007	1.82	Adit drainage Upland waste rock	GW SW	1 3	GWT: Cu-1, Sb-1, Zn-1 SWT: Cd-3, Cu-2, Fe-1, Pb-1	SWD: Cd-2, Mn-3 SWT: Fe-1, Mn-3	SWD: Zn-2 SWT: Cu-1, Zn-3
NABOB 600 LEVEL (300 Level)	MAS013	0.42	Upland waste rock (erosion potential)					
NABOB 600 LEVEL (Crystalite)	MAS008	1.36	Upland waste rock (erosion potential)					
NABOB 600 LEVEL SHAFT	MAS035	0.30	Upland waste rock (erosion potential)					
NABOB MILLSITE	MAS083	2.81	Upland tailings Upland waste rock	SD SW	1 1	SDT: As-1, Cd-1, Cu-1, Fe-1, Pb-1, Zn-1 SWT: Cd-1, Fe-1, Mn-1	SWT: Cu-1, Pb-1, Zn-1	
NABOB TAILINGS POND	MAS006	4.10	Floodplain tailings (flotation tailings)	SB SS	1 1	SBT: As-1, Fe-1, Mn-1, Zn-1 SST: Cd-1	SBT: Pb-1 SST: As-1, Cu-1, Pb-1, Sb-1, Zn-1	
NEVADA TUNNEL & ROCK DUMP	MAS080	0.43	Upland waste rock					
NEVADA-STEWART MINE	MAS021	0.63	Adit drainage Seep Upland waste rock (erosion potential)	SW	3	SWD: Cd-2, Cu-1 SWT: Cd-1, Cu-2, Fe-1	SWD: Mn-2, Zn-1 SWT: Fe-1, Mn-2, Zn-1	SWD: Zn-2 SWT: Zn-2
OWL/FRED MINE	MAS052	0.22	Adit drainage Upland waste rock (erosion potential)					
SHETLAND MINING CO-NABOB SILVER-LEAD	MAS009	0.31	Adit drainage Upland waste rock (erosion potential)	SW	2	SWT: Cu-2, Fe-1, Mn-1, Pb-1		
SIDNEY (DENVER) 500 LEVEL	MAS017	2.61	Adit drainage Upland waste rock (erosion potential)	SW	1	SWD: Mn-1, Pb-1		SWD: Cd-1, Zn-1
SIDNEY (DENVER) 500 LEVEL ADJ ADITS	MAS069	1.89	Upland waste rock					

Table 4.1-1
Potential Source Areas Within Pine Creek - segment PineCrkSeg01

Source Area Name	Source ID	Area (Acres)	Source Description	No. Samples By Matrix Type	Metals > 1X	Metals > 10X	Metals > 100X
SIDNEY (RED CLOUD) LOWER ROCK DUMP	MAS082	0.62	Upland waste rock				
SIDNEY (RED CLOUD) MINE/MILLSITE	MAS020	5.66	Adit drainage	SD 3 SW 8	SDT: As-3, Cd-2, Cu-3, Mn-1, Pb-1, Zn-2 SWD: Cd-1, Cu-1, Mn-2, Pb-1 SWT: Cd-4, Fe-2, Mn-1, Pb-2	SDT: Pb-2, Zn-1 SWD: Cd-2, Mn-1, Pb-3, Zn-1 SWT: Cd-1, Cu-2, Mn-1, Pb-1, Zn-2	SWD: Cd-1, Zn-2 SWT: Zn-2
SIDNEY (RED CLOUD) ROCK DUMP	MAS081	2.10	Floodplain waste rock				
SILVER BAND GROUP	MAS075	0.19	Upland waste rock				
STAR ANITMONY UPPER ADIT	MAS058	0.30	Upland waste rock				
STAR ANTIMONY LOWER ADIT	MAS019	0.35	Floodplain waste rock				
STAR ANTIMONY UPPER ROCK DUMP	MAS076	0.45	Upland waste rock				
STEUNENBERG CLAIM	MAS077	1.09	Upland waste rock				
SURPRISE MINE & UPPER ROCK DUMP	MAS022	1.68	Floodplain waste rock				
TRAPPER CREEK SILVER	MAS030	0.28	Upland waste rock (erosion potential)				
TRAPPER MINING & SMELTING COMPANY LTD.	MAS031	0.18	Upland waste rock (erosion potential)				
UNIDENTIFIED DISTURBANCE	MAS073	0.18	Upland waste rock				
UNIDENTIFIED DISTURBANCE	MAS074	0.43	Upland waste rock				
UNNAMED ADIT	MAS051	0.23	Upland waste rock				
UNNAMED ADIT	MAS055	0.24	Upland waste rock (erosion potential)				
UNNAMED ADIT	MAS057	0.17	Upland waste rock (erosion potential)				
UNNAMED ADIT	MAS059	0.28	Upland waste rock				
UNNAMED ADIT	MAS061	0.31	Upland waste rock				
UNNAMED ADIT	MAS062	0.23	Upland waste rock				
UNNAMED ADIT	MAS063	0.15	Upland waste rock				
UNNAMED ADIT	MAS068	0.16	Upland waste rock (erosion potential)				
UNNAMED ADIT	MAS072	0.33	Upland waste rock (erosion potential)				
UNNAMED ADITS	MAS053	0.45	Upland waste rock (erosion potential)				
UNNAMED PROSPECT	MAS056	0.19	Upland waste rock				
UNNAMED PROSPECT	MAS065	0.20	Upland waste rock (erosion potential)				
UNNAMED PROSPECT	MAS071	0.25	Upland waste rock				

Table 4.1-1
Potential Source Areas Within Pine Creek - segment PineCrkSeg01

Source Area Name	Source ID	Area (Acres)	Source Description	No. Samples By Matrix Type	Metals > 1X	Metals > 10X	Metals > 100X

Matrix Types

DR: Debris/Rubble	SD: Sediment
GW: Groundwater	SL: Soil
RK: Rock/Cobbles/Gravel	SS: Surface Soil
SB: Subsurface Soil	SW: Surface Water

Matrix Groupings

GWD: Groundwater - Dissolved Metals	SST: Surface Soil
GWT: Groundwater - Total Metals	SWD: Surface Water - Dissolved Metals
SBT: Subsurface Soil	SWT: Surface Water - Total Metals
SDT: Sediment	

Analytes

Ag: Silver	Hg: Mercury
As: Arsenic	Mn: Manganese
Cd: Cadmium	Pb: Lead
Cu: Copper	Sb: Antimony
Fe: Iron	Zn: Zinc

Table 4.1-2
Potential Source Areas Within Pine Creek - segment PineCrkSeg02

Source Area Name	Source ID	Area (Acres)	Source Description	No. Samples By Matrix Type	Metals > 1X	Metals > 10X	Metals > 100X
BLUEBIRD PROSPECT (HANNIBAL)	TWI013	0.32	Upland waste rock				
EQUITABLE PROSPECT	TWI009	0.27	Floodplain waste rock				
GREAT DUNKARD MINE	TWI014	0.25	Floodplain waste rock				
INEZ GROUP: NO. 1	TWI005	0.30	Upland waste rock				
INEZ GROUP: NO. 2	TWI004	0.23	Upland waste rock				
INEZ GROUP: NO. 3	TWI003	0.16	Upland waste rock				
INTERNATIONAL MINE	TWI016	0.25	Upland waste rock				
KC PROSPECT	TWI012	0.16	Floodplain waste rock				
LONE PINE MINE	TWI010	0.33	Upland waste rock				
MANHATTAN MINE	TWI006	0.20	Upland waste rock (erosion potential)				
PALISADE MINE BLACKSMITH SHOP WORKINGS	TWI001	0.56	Upland waste rock				
PALISADE MINE LOWER WORKINGS	TWI002	0.24	Floodplain waste rock				
PALISADE MINE ROCK DUMP	TWI023	0.50	Upland waste rock				
PALISADE MINE SURFACE DISTURBANCE	TWI022	0.73	Upland waste rock				
SHERMAN PROSPECT	TWI015	0.32	Upland waste rock				
TIBERIUS PROSPECT	TWI017	0.27	Upland waste rock				
UNNAMED ADIT	TWI011	0.23	Upland waste rock (erosion potential)				
UNNAMED ADIT	TWI020	0.24	Upland waste rock (erosion potential)				
UNNAMED ADIT	TWI021	0.22	Upland waste rock				
UNNAMED ADIT	TWI029	0.24	Upland waste rock				
UNNAMED ADIT	TWI030	0.28	Upland waste rock (erosion potential)				
UNNAMED PROSPECT	TWI018	0.31	Upland waste rock (erosion potential)				
UNNAMED PROSPECT	TWI019	0.33	Upland waste rock				
UNNAMED PROSPECT	TWI024	0.42	Upland waste rock				
UNNAMED PROSPECT	TWI025	0.30	Upland waste rock				
UNNAMED PROSPECT	TWI026	1.38	Upland waste rock				
UNNAMED PROSPECT	TWI027	0.23	Upland waste rock (erosion potential)				
UNNAMED PROSPECT	TWI028	0.18	Upland waste rock				
WEST PINE CREEK DEPOSIT	TWI008	0.21	Floodplain waste rock				
WESTERN KING PROSPECT	TWI007	0.25	Upland waste rock				

Table 4.1-2
Potential Source Areas Within Pine Creek - segment PineCrkSeg02

Source Area Name	Source ID	Area (Acres)	Source Description	No. Samples By Matrix Type	Metals > 1X	Metals > 10X	Metals > 100X

Matrix Types

DR: Debris/Rubble	SD: Sediment
GW: Groundwater	SL: Soil
RK: Rock/Cobbles/Gravel	SS: Surface Soil
SB: Subsurface Soil	SW: Surface Water

Matrix Groupings

GWD: Groundwater - Dissolved Metals	SST: Surface Soil
GWT: Groundwater - Total Metals	SWD: Surface Water - Dissolved Metals
SBT: Subsurface Soil	SWT: Surface Water - Total Metals
SDT: Sediment	

Analytes

Ag: Silver	Hg: Mercury
As: Arsenic	Mn: Manganese
Cd: Cadmium	Pb: Lead
Cu: Copper	Sb: Antimony
Fe: Iron	Zn: Zinc

Table 4.1-3
Potential Source Areas Within Pine Creek - segment PineCrkSeg03

Source Area Name	Source ID	Area (Acres)	Source Description	No. Samples By Matrix Type	Metals > 1X	Metals > 10X	Metals > 100X
AMY-MATCHLESS MILLSITE	KLW081	5.07	Adit drainage Floodplain sediments Seep	GW 2 SB 4 SS 2 SW 16	GWT: Fe-2, Mn-2, Pb-1 SBT: As-2, Cd-1, Cu-4, Fe-2, Pb-1, Zn-1 SST: As-2, Cu-1, Fe-1, Sb-2, Zn-2 SWD: Cd-12, Mn-3, Pb-4, Zn-14 SWT: Cd-1, Cu-1, Fe-1, Mn-3, Pb-1, Zn-12	GWT: Zn-2 SBT: As-1, Cd-1, Pb-3, Zn-3 SST: Pb-2 SWD: Cd-1, Pb-1, Zn-1 SWT: Zn-3	GWT: Cu-2
BOBBY ANDERSON MINE	KLW080	0.30	Upland waste rock				
CARBONATE MINE: NO. 1	KLW085	0.60	Floodplain waste rock				
CARBONATE MINE: NO. 2	KLW082	0.34	Floodplain waste rock				
COEUR D ALENE ANTIMONY MINE	KLW072	1.04	Upland waste rock				
CORBY MINE	KLW078	1.23	Upland waste rock				
CORBY MINE	KLW105	1.59	Upland waste rock Upland waste rock				
CORBY MINE	KLW106	0.37	Mine Workings/Water, Seeps, Springs and Leachate				
DEGERSTROM PIT	KLW076	1.17	Upland waste rock				
EAST HYPOTHEEK MINE	MAS001	1.08	Upland waste rock				
GENERAL MINE	KLW077	0.46	Floodplain waste rock				
GOLD EAGLE MINING CO.	KLW079	0.40	Floodplain waste rock				
LIBERAL KING MINE & MILLSITE	MAS003	3.86	Adit drainage Seep Upland waste rock (intermixed tailings)	SW 3	SWT: Zn-3		
LIBERAL KING PART OF TUNNEL: NO. 1	KLW084	0.34	Upland waste rock				
LIBERAL KING PART OF TUNNEL: NO. 2	KLW083	0.58	Floodplain waste rock				
LIBERAL KING TAILINGS	MAS002	2.33	Floodplain tailings				
MATCHLESS MINE	KLW075	0.71	Floodplain waste rock				
NORTHERN LIGHT MINE	KLW074	0.30	Upland waste rock				
PINEHURST ROCK PIT ALONG I-90: NO. 2	KLW005	5.73	Floodplain waste rock				
SILVERSTONE MINE	KLW073	0.35	Upland waste rock				
UNNAMED ADIT	MAS064	0.25	Upland waste rock				
UNNAMED PROSPECT	MAS066	0.25	Upland waste rock				

Table 4.1-3
Potential Source Areas Within Pine Creek - segment PineCrkSeg03

Source Area Name	Source ID	Area (Acres)	Source Description	No. Samples By Matrix Type	Metals > 1X	Metals > 10X	Metals > 100X

Matrix Types		Matrix Groupings		Analytes	
DR: Debris/Rubble	SD: Sediment	GWD: Groundwater - Dissolved Metals	SST: Surface Soil	Ag: Silver	Hg: Mercury
GW: Groundwater	SL: Soil	GWT: Groundwater - Total Metals	SWD: Surface Water - Dissolved Metals	As: Arsenic	Mn: Manganese
RK: Rock/Cobbles/Gravel	SS: Surface Soil	SBT: Subsurface Soil	SWT: Surface Water - Total Metals	Cd: Cadmium	Pb: Lead
SB: Subsurface Soil	SW: Surface Water	SDT: Sediment		Cu: Copper	Sb: Antimony
				Fe: Iron	Zn: Zinc

Table 4.1.4-1
Adit and Seep Data Summary

BLM ID	Source Name	Average Discharge (cfs)	Maximum Discharge (cfs)	Average Total Zinc Concentration (µg/L)	Average Total Zinc Load (lbs/day)
Adits					
MAS020	Sidney (Red Cloud)	0.018	0.089	43,700	4.2
MAS021	Nevada-Stewart	0.074	0.111	9,833	3.9
MAS007	Nabob 1300 Level	0.051	0.074	7,665	2.1
MAS078	Highland Surprise	0.038	0.04	2,853	0.58
MAS050	Constitution Upper Tunnel	0.079	0.098	328	0.14
MAS016	Little Pittsburg No. 1	0.00042	0.00042	61,400	0.14
MAS015	Little Pittsburg No. 2	0.00174	0.00179	8,150	0.076
MAS011	Idaho Prospect No. 2	0.00064	0.00064	10,500	0.036
MAS004	Lookout Mountain	0.0268	0.027	49	0.0071
MAS054	SF Fraction (Marmion)	0.0089	0.0089	111	0.0053
KLW081	Amy-Matchless	0.0043	0.00821	211	0.0049
MAS003	Liberal King	0.0046	0.00656	58	0.0014
MAS029	Big It	0.00106	0.00106	36	0.00021
MAS009	Shetland Mining Co.	0.000651	0.000825	14	0.000049
MAS012	Lynch-Pine Creek	No data	No data	15,900	No discharge data
MAS014	Hilarity	No data	No data	6,230	No discharge data
MAS017	Sidney (Denver) 500 Level	No data	No data	3,460	No discharge data
MAS052	Owl/Fred	No data	No data	452	No discharge data
MAS010	Idaho Prospect No. 1	No data	No data	No data	No data
MAS023	Blue Eagle	No data	No data	No data	No data
MAS025	Douglas	No data	No data	No data	No data
Seeps					
KLW081	Amy-Matchless	0.426	0.68	888	2.0
MAS078	Highland-Surprise	0.0106	0.0106	7,700	0.44
MAS021	Nevada-Stewart	0.0028	0.0028	2,735	0.04
MAS014	Hilarity	No data	No data	7,500	No discharge data
MAS036	Denver Cr. tailings pile	No data	No data	3,690	No discharge data
MAS003	Liberal King	No data	No data	1,430	No discharge data

Table 4.1.4-1 (Continued)
Adit and Seep Data Summary

BLM ID	Source Name	Average Discharge (cfs)	Maximum Discharge (cfs)	Average Total Zinc Concentration (µg/L)	Average Total Zinc Load (lbs/day)
MAS049	Upper Constitution (non-BLM land)	No data	No data	1,300	No discharge data
MAS015	Little Pittsburg No. 2	No data	No data	640	No discharge data
MAS026	Upper Constitution (BLM land)	No data	No data	111	No discharge data
MAS067	Lookout Mountain	No data	No data	17	No discharge data

Notes:
Data compiled from the Restorations Alternative Plan (Gearheart et al. 1999). See Appendix J.

cfs - cubic feet per second
µg/L - micrograms per liter
lbs/day - pounds per day

Table 4.2-1
Pine Creek Mass Loading

Location	Segment	Sample Type	Sample Date	Flow (CFS)	Flow Delta	Total Lead			Dissolved Zinc		
						Conc. (µg/L)	Load (lbs/day)	Delta[a] (lbs/day)	Conc (µg/L)	Load (lbs/day)	Delta[a] (lbs/day)
PC306	1	RV	13-Nov-97	0.8	0.0	0.13	<0.1	-	<1	<1	-
PC312	1	RV	11-Nov-97	15.3	14.5	0.68	0.1	0.1	415	34.2	34.2
PC315	3	RV	04-Nov-97	60.0	44.7	0.62	0.2	0.1	102	33.0	-1.2
PC307	1	SS	01-Nov-97	3.9	-	2.6	0.1	-	1370	29.0	-
PC 308	1	SS	01-Nov-97	0.19	-	13.2	<0.0	-	7080	7.3	-
PC310	1	SS	01-Nov-97	0.2	-	77.8	0.1	-	3430	3.0	-
PC 311	2	SS	01-Nov-97	19.9	-	0.15	<0.1	-	2.5	0.3	-
PC306	1	RV	16-May-98	5.95	-	<1	-	-	1.9	0.1	-
PC338	1	RV	15-May-98	43.7	37.8	1.3	0.3	#VALUE!	107	25.2	25.1
PC360	1	RV	01-May-98	72.5	28.8	1.4	0.5	0.2	190	74.2	49.0
PC312	1	RV	14-May-98	70.6	-1.9	1.1	0.4	-0.1	188	71.5	-2.7
PC339	3	RV	16-May-98	205	134.4	0.69	0.8	0.3	87.2	96.4	24.8
PC313	3	RV	14-May-98	198	-7.0	0.4	0.4	-0.3	62	66.2	-30.2
PC315	3	RV	14-May-98	202	4.0	2.3	2.5	2.1	68	74.0	7.9
PC307	1	SS	01-May-98	8.36	-	2	0.1	-	679	30.6	-
PC308	1	SS	01-May-98	0.185	-	5.5	<0.1	-	3000	3.0	-
PC323	1	SS	01-May-98	0.88	-	3.2	<0.1	-	1090	5.2	-
PC322	1	SS	01-May-98	7.14	-	2.8	0.1	-	561	21.6	-
PC325	1	SS	01-May-98	0.135	-	0.41	<0.1	-	3920	2.9	-
PC324	1	SS	01-May-98	0.27	-	31.9	<0.1	-	9.7	0.0	-
PC326	1	SS	01-May-98	0.07	-	13.6	<0.1	-	728	0.3	-
PC311	2	WF	01-May-98	136	-	0.2	0.1	-	10	7.3	-
PC339	3	RV	19-Nov-98	33	-103.0	1	0.2		139	24.7	
PC313	3	RV	16-Nov-98	9.332	-23.7	1.4	0.1	0.1	96.8	4.9	-19.9

Table 4.2-1 (Continued)
Pine Creek Mass Loading

[a]The Delta value reported at a sample location is the difference between Mass load at that location and the next upstream Sample location, except for side streams and adits which are the maas load at that location.

Notes:
- : Mass Load or Delta Not Calculated
RV: River Sample
SS: Samples Collected in Side Stream off the Main Stream Channel (Including East Fork)
WF: Samples Collected in West Fork Pine Creek
CFS: Cubic feet per Second
µg/L: Micrograms per liter
lbs/day: pounds per day

5.0 FATE AND TRANSPORT

The fate and transport of metals in surface water, groundwater, and sediment in the Pine Creek Watershed are discussed in this section. A conceptual model of fate and transport, important fate and transport mechanisms, and a summary of the probabilistic model developed to evaluate fate and transport, were presented in the fate and transport section in the Canyon Creek report and are not repeated here. This section draws upon that general information.

Initial findings on metals concentrations and mass loading for each segment, as presented above in Section 4, Nature and Extent, are briefly summarized in Section 5.1. Results of the probabilistic modeling are presented in Section 5.2. Sediment transport is summarized in Section 5.3. A summary of fate and transport of metals in Pine Creek is presented in Section 5.4.

5.1 INTRODUCTION

Pine Creek contributes significant quantities of cadmium, lead, zinc, and other metals to the South Fork. The lowest and highest dissolved cadmium and zinc and total lead loadings measured during six sampling events (May 1991; October 1991; November 1997; May 1998; November 1998; and May 1999) are listed in Table 5.1-1. Potential sources of these metals in the watershed were identified for each segment in Section 4.1 and preliminary mass loading estimates were discussed in Section 4.2. Brief summaries of those results are included in this section.

Segment PineCrkSeg01 contains the headwaters of the East Fork of Pine Creek up to its confluence with the main stem of Pine Creek (Figure 4.1-1). The BLM identified 78 source areas in this segment. Sampling of surface water indicates that metals concentrations are greater than ambient water quality criteria (AWQC).

Segment PineCrkSeg02 contains the headwaters of Pine Creek (including the West Fork of Pine Creek) up to its confluence with the East Fork (Figure 4.1-4). The BLM identified 30 source areas in this segment. The majority of these are small, undeveloped prospects or mines. No tailings deposits are present. Sampling of surface water indicates that metals concentrations in surface water are rarely greater than AWQC.

Segment PineCrkSeg03 begins at the confluence of the East Fork with the main stem of Pine Creek and continues to the confluence of Pine Creek with the South Fork Coeur d'Alene River

(Figure 4.1-5). The BLM identified 23 source areas in this segment. Sampling of surface water indicates that metals concentrations in surface water are greater than AWQC.

5.2 MODEL RESULTS

Results from the probabilistic model are discussed for cadmium, lead, and zinc in this section. Modeling results for estimates of discharge are discussed in Section 5.2.1. Modeling results for estimates of chemical concentrations and mass loading of cadmium, lead, and zinc are discussed in Section 5.2.2. Data and associated calculations are included in Appendix C.

Data were evaluated for three separate sampling locations. Only sampling locations with 10 or more individual data points for each parameter of interest were evaluated. In the Pine Creek watershed, the three sampling locations, in order from upstream in the East Fork Pine Creek (East Fork) to the mouth of Pine Creek are PC307, PC308, and PC305. The three sampling locations are shown on Figure 5.2-1. The first sampling location, PC307, is located at the confluence of Highland Creek and the East Fork. Sampling location PC308 is located approximately one-half mile downstream from PC307 at the confluence of Denver Creek with the East Fork. The two sampling locations previously mentioned are in segment PineCrkSeg01. The last sampling location evaluated (PC305) is near the confluence of Pine Creek with the South Fork Coeur d'Alene River (PineCrkSeg03).

River stretches bracketed by sampling locations are designated as reaches. For example, the portion of Pine Creek lying between sampling locations PC307 and PC308 is called a reach. Accordingly, there are two reaches encompassed by the three sampling locations.

5.2.1 Estimated Discharge

An example of the lognormal distribution of discharge data at sampling location PC305 at the mouth of Pine Creek is shown in Figure 5.2-2. Data from sampling location PC305 are used throughout this discussion for consistency of presentation and, additionally, because it lies near the mouth of Pine Creek. Further, a relatively large data set was available. In Figure 5.2-2, the discharge in cubic feet per second (cfs) is plotted on a log scale versus the normal standard variate. The normal standard variate is equivalent to the standard deviation for a normalized variable. When the log of a parameter (e.g., discharge) is plotted versus the standard normal variate, a straight line will result if the data are lognormally distributed. The cumulative distribution function gives the probability that the observed discharge at any given time will not be exceeded by the estimated discharge at that cumulative probability. The cumulative distribution function is plotted versus the normal standard variate in Figure 5.2-3. To determine the probability of occurrence of a specific discharge, first select the discharge of interest on Figure 5.2-2, then find its corresponding normal standard variate. Using that value for the normal standard variate, look up its corresponding cumulative probability in Figure 5.2-3. For example, for a discharge of 100 cfs, the normal standard variate is approximately 0.2 (Figure 5.2-2). Looking on Figure 5.2-3, this value corresponds to a cumulative probability of approximately 0.58; therefore, approximately 58 percent of the time, discharges at this location will be 100 cfs or less.

As shown in Figure 5.2-2, there is a good fit of the lognormal regression line (solid line in Figure 5.2-2) to the data. This goodness of fit, as evidenced by a high coefficient of determination (r^2 = 0.98) (significant at a < 0.0001), supports the assumption that discharges are lognormally distributed. The dotted line represents the true (ideal) lognormal distribution having the same mean (200) and coefficient of variation (1.88) as the actual data. The expected value, or average discharge rate, for Pine Creek at sampling location PC305 is 215 cfs. Expected values for discharge at all three sampling locations are summarized in Table 5.2-1.

The probability distribution function (PDF) shown in Figure 5.2-2 is a predictive tool that can be used to estimate the expected discharge and provide a quantitative estimate of the probability that the observed discharge will not exceed a given value. Conversely, one can find the estimated discharge rate having a specified probability of exceedance or non-exceedance by the observed discharge.

Estimated gains or losses in discharge (EV) and the coefficients of variation (CV) for reaches on Pine Creek are listed in Table 5.2-2.

One of the reaches (between PC307 and PC308) loses an estimated 4.8 cfs. The gaining reach (between PC308 and PC305) gains, approximately, an estimated 214 cfs. Gains in discharge occur mainly because of tributary inflows and high slopes that enhance overland flow.

5.2.2 Estimated Zinc, Lead, and Cadmium Concentrations and Mass Loading

Dissolved cadmium and zinc, and total lead concentrations and loads were evaluated using the probabilistic model at the three sampling locations (two reaches) that contained a minimum of ten data points.

5.2.2.1 Individual Sampling Locations

To illustrate the lognormal distribution of dissolved zinc and cadmium and total lead concentrations and dissolved zinc, total lead, and dissolved cadmium loading at sampling location PC305 in Pine Creek, Figures 5.2-4 through 5.2-9 are provided. The high r-squared values (r^2) for the concentrations and loads when plotted lognormally attest to the fact that the data follow a lognormal distribution. For dissolved concentrations, the r-squared values for zinc, and cadmium were 0.88 and 0.95, respectively. The r-squared value for the total lead concentration was 0.98. Corresponding values for dissolved zinc and cadmium, and total lead loads were 0.98, 0.95, and 0.92, respectively.

To assist in interpreting and placing the results in context, screening levels, expected values (EV), and total maximum daily loads (TMDLs) are shown on the figures where applicable. The TMDLs are given at the 10th, 50th, and 90th percentiles when the scale permitted. Often, it was necessary to multiply the TMDL by a scalar to fit it on the graph. The TMDLs used were those presented in the Technical Support Document of August 2000 (USEPA 2000). Strictly speaking, TMDLs for non-point sources are for dissolved loads. However, the TMDL for total lead load was multiplied by a value [called a translator (USEPA 2000), which gives the ratio of the total to dissolved loads] to convert the dissolved lead TMDL load to a total lead load. The purpose of this exercise was to provide a reference value and point of discussion for lead because of the importance of the total lead load. Often, most of the lead will be in the particulate, as opposed to dissolved, form. Because a high percentage of zinc and cadmium loads are in the dissolved form, zinc and cadmium were compared to their respective dissolved TMDL loading capacities.

The screening level for dissolved cadmium in surface waters is 0.38 µg/l. Several cadmium measurements at PC305 were above this screening level. None of the measured cadmium concentrations exceeded 10 times the screening level (Figure 5.2-4). The estimated dissolved cadmium concentration of approximately 0.54 µg/l is slightly above the screening level.

All total lead concentrations are less than the screening level (15 µg/l) except for one data point (Figure 5.2-5). The estimated expected lead concentration (approximately 4.6 µg/l) is also less than the screening level.

Almost all dissolved zinc concentrations (Figure 5.2-6) measured at sampling location PC305 on Pine Creek fall between the screening level and 10 times the screening level of 42 µg/l. The estimated dissolved zinc concentration (112 µg/l) exceeds the screening level for zinc.

The 90th percentile value of the TMDL for the dissolved cadmium load at the mouth of Pine Creek is 0.771 pounds/day. This value was exceeded by the majority of the data points (Figure 5.2-7). The estimated value of 5.38 pounds/day is approximately seven times the 90th percentile TMDL for the dissolved cadmium load.

The 90th percentile TMDL for total lead (see previous comments on TMDL adjustment for lead) at the mouth of Pine Creek (1.13 pounds/day) was exceeded by the majority of the plotted measurements (Figure 5.2-8). The estimated total lead load at the mouth of Pine Creek is approximately 12 pounds/day. The estimated expected value exceeds by more than 10 times the 90th percentile value for Pine Creek.

As indicated on Figure 5.2-9, many measurements of dissolved zinc loading exceeded the 90th percentile TMDL (67.4 pounds/day) for the dissolved zinc load at the mouth of Pine Creek. A few of the measured values exceeded 10 times the 90th percentile TMDL for zinc. The estimated zinc load at PC305 (90.2 pounds/day) exceeds the 90th percentile TMDL.

Figures similar to Figures 5.2-4 to 5.2-9 were developed for each of the three sampling locations. The results of these and additional analyses are presented in Appendix C. Data in Appendix C were used to compute estimated expected values and coefficients of variation for dissolved and total zinc, lead, and cadmium concentrations and loads in the two reaches of Pine Creek and the East Fork. The resulting computations are presented in Tables 5.2-3 to 5.2-8. The calculations were performed in the same manner as described in the discharge section (Section 5.2.1).

The expected values of dissolved and total zinc concentrations and loads were relatively high, especially dissolved and total concentrations, at the first sampling location (PC307). Total and dissolved concentrations decrease in the last reach. Dissolved and total loads increase in the last reach. These trends are discussed reach by reach within the segments.

Dissolved and total lead concentrations decrease in the last reach. Dissolved and total lead loads decrease in the first reach and increase in the last reach. Changes in the estimated concentrations and loadings are further discussed in the reach by reach evaluation.

Estimated values of dissolved and total cadmium concentrations increase in the first reach and decrease in the second reach. Conversely, estimated values of dissolved and total cadmium loads decrease in the first reach and increase in the second reach. Estimated dissolved and total cadmium concentrations and loads are discussed in the reach by reach analysis.

5.2.2.1.1 Segment PineCrkSeg01. Segment PineCrkSeg01 comprises the East Fork and tributaries. This segment contains most of the potential source areas in the watershed. Concentrations of dissolved metals exceed screening levels by up to approximately 10-fold at the downstream portion of this segment. Zinc loading occurs on the order of tens of pounds per day. Excavation and removal of mining wastes on BLM lands have taken place in this segment. The excavated material was relocated to the Central Impoundment Area near Kellogg. At several of the mines and mills where work was performed by the BLM, mining wastes remain on private land. At certain locations, these remaining mining wastes are being eroded to the creek during high flow or are in imminent danger of being eroded.

Two sampling locations (PC307 and PC308) lying within this segment were analyzed probabilistically. These sampling locations are situated on the East Fork at the confluences of Highland Creek (PC307) and Denver Creek (PC308) with the East Fork.

At PC307, dissolved zinc concentrations (estimated value of approximately 974 µg/l) already exceed screening levels for dissolved zinc in surface waters (42 µg/l) by 23-fold. Estimated dissolved zinc loads at PC307 (approximately 26 pounds/day) do not exceed the 90th percentile TMDL for dissolved zinc loads (67.4 pounds/day at the mouth of Pine Creek).

At PC307, the estimated value of the total lead concentration (4.5 µg/l) is lower than the corresponding screening level (15 µg/l). The total estimated lead load at PC307 (approximately 0.2 pounds/day) does not exceed the 90th percentile TMDL for lead (1.13 pounds/day).

The estimated value of the dissolved cadmium concentration (approximately 2.6 µg/l) at PC307 exceeded the screening level for dissolved cadmium (0.38 µg/l). The estimated value for the dissolved cadmium load (approximately 0.07 pounds/day) did not exceed the 90th percentile TMDL (0.771 pounds/day) for the dissolved cadmium load at the mouth of Pine Creek.

Accordingly, upstream sources contribute metal concentrations and loads at PC307 that exceed screening levels but do not exceed the corresponding loading capacities at the mouth of Pine Creek. Potential contributors to metal concentrations and loadings observed at PC307 include the Constitution Mine Complex, the Owl/Fred Mine, the Douglas Mine Tailings and the Star Antimony Adit and Rock Dump.

Zinc, lead, and cadmium behaved similarly within this reach (between PC307 and PC308) in that, for all three metals, dissolved and total metal concentrations increased while loads decreased. Dissolved zinc concentrations increased dramatically (by approximately 3,400 µg/l). The decreased metal load is commensurate with the decreased discharge. Discharge decreased by an estimated 4.8 cfs in this reach falling from an estimated 5.6 to 0.8 cfs. The percentage decrease in discharge is greater than the percentage increase in concentration, which resulted in decreased loading. The Denver Mine adit, the Pittsburgh Mine, and the Hilarity Mine are potential contributors to the dramatically increased concentrations within this reach.

Based on modeling results, the percentages of zinc, lead, and cadmium loads thought to be in the dissolved phase are, approximately, 100 percent, 50 percent, and 100 percent, respectively, at the last sampling location (PC308) within this segment.

Estimated total loads contributed by segment PineCrkSeg01 are minimally (downstream to PC308) thought to be approximately 18.5 pounds/day (zinc), approximately 0.04 pounds/day (lead), and approximately 0.05 pounds/day (cadmium).

5.2.2.1.2 Segment PineCrkSeg02. Segment PineCrkSeg02 includes upper Pine Creek and tributaries. No tailings deposits are found in this segment but a number of potential sources exist. Releases of metals to the creek are minimal and only minimal impacts from this segment are anticipated.

5.2.2.1.3 Segment PineCrkSeg03. Segment PineCrkSeg03 of the Pine Creek watershed includes lower Pine Creek from its confluence with the East Fork to the South Fork Coeur d'Alene River to its mouth. There are a number of potential sources of mining wastes. As with segment PineCrkSeg01, some excavation and waste removals have occurred; however, some removals from BLM land did not include adjacent private land, and waste remains in place with threat of ongoing erosion to the creek. Concentrations of dissolved metals are lower in this segment of Pine Creek than in segment PineCrkSeg01 and loading from this segment to the South Fork of the Coeur d'Alene River is approximately the same as loading at the upper end of this segment.

Between PC308 in segment PineCrkSeg01 and PC305 in segment PineCrkSeg03, estimated dissolved zinc, lead and cadmium concentrations decreased while dissolved and total loads for these same elements increased. For example, dissolved zinc concentrations decreased by an estimated 4,300 µg/l while the estimated dissolved zinc load increased by approximately 72 pounds/day. Discharge in this reach increased by over 200 cfs. Several tributary creeks, including Pine Creek, contribute to the increased discharge. The significant increase in discharge results in increased loading and decreased concentrations. Water contributing to the loading (e.g., from upper Pine Creek) has lower metal concentrations and fewer potential sources than water from the East Fork.

Estimated total lead concentrations increased in this reach (between PC308 and PC305). Increased discharges appear to result in increased particulate loading. Because lead tends to associate strongly with the particulate phase, increased particulate loads bring about increased total lead concentrations. Potential sources in this reach contributing to the increased metal loading include the Nabob Mine complex, Denver Creek tailings pile, Liberal King tailings, the Matchless Mine, and the Coeur d'Alene Antimony Mine.

At the mouth of Pine Creek (PC305), the estimated dissolved zinc concentration exceeds the screening level of 42 µg/l. The estimated dissolved cadmium concentration of approximately 0.54 µg/l is slightly above the screening level of 0.38 µg/l. Dissolved zinc and cadmium loads and the total lead load surpass their corresponding 90th percentile TMDLs.

Probabilistic modeling indicates that the estimated percentages of the total metal loads found in the dissolved form are 92 percent dissolved for zinc, 44 percent dissolved for lead, and 93 percent dissolved for cadmium (Appendix C). The USGS had suggested (Woods 2000) that the total lead may be underestimated because of improper sampling techniques.

5.2.2.1.4 Concentrations Versus Discharge. The following discussion is based on evaluation of probabilistic modeling data for the mouth of Pine Creek (PC305) (Appendix C). There is an increase in dissolved zinc concentrations with increased discharge that is significant at a = < 0.003 (a is the probability the correlation is due to chance). Increased zinc concentration with increased discharge is atypical for zinc. As one would expect, given that the majority of the zinc is in the dissolved phase, there is also an increase in total zinc concentrations with increased discharge rates (a = < 0.0005). Total lead concentrations increased with increasing discharge (a < 0.03). Similarly to zinc, estimated values of dissolved (a < 0.0001) cadmium concentrations also indicated increased concentrations with increased discharge at the mouth of Pine Creek.

The regressions permit estimation of dissolved zinc, lead, and cadmium concentrations at various discharge rates. Similar regressions were developed at the other sampling locations. The remaining two sampling locations exhibit decreases in dissolved zinc and cadmium concentrations with increasing discharge rates (Appendix C). Estimated total lead concentrations increase when discharge increases. Increased total lead concentrations with increased discharge are a consequence of the correlation between discharge and suspended sediments and suspended sediments with lead.

5.3 SEDIMENT FATE AND TRANSPORT

Sediment transport processes were discussed in detail in Section 3. Brief summaries of sediment transport processes active in the watershed are presented in this section, followed by descriptions of sediment sources and transport processes observed in each segment.

5.3.1 Sediment Transport Processes

The physical processes of rain falling on soil, runoff from snowmelt or precipitation, channel bank and bed erosion, or mass movement incorporates sediment into streams of water. Water in streams transports, deposits, and sorts the delivered sediment based on the stream energy, discharge, and size and quantity of sediment.

Sediment transport by streams is a natural process; however, human activities such as mining, logging, road building, urbanization, or land clearing can significantly increase the rate at which sediment transport occurs. For instance, land clearing exposes soil and rock that may be subject to erosion. Further, this disturbance may decrease the amount of water storage in the soil, increasing runoff rates and providing additional surface water and energy for sediment transport.

The rate at which sediment passes through a cross section of a stream system is referred to as the sediment yield. This annual sediment yield may be broken down into components that describe the method of transport, suspended load and bedload. Suspended load consists of particles small and light enough to be carried downstream in suspension by shear and eddy forces in the water column. Bedload consists of larger and heavier particles that move downstream by rolling, sliding or hopping on the channel bed (Dunne and Leopold 1978).

Sediment transport (particulate metal loading) occurs at even the smallest of stream channel discharge but the majority of movement occurs during moderate to high discharge when shear forces are greatest (Leopold et al 1992). High-flow periods usually occur in the spring as a result of precipitation and snowmelt but can occur in midwinter for the same reasons. Physical erosion of riverbanks and channels during high-flow events causes particulate forms of metals to reenter the river and be transported. There is a propensity for increased erosion during high-flow events and following high flow events when river banks are saturated and the river stage decreases and a propensity for sediment deposition as river stage decreases. Upon entering Pine Creek, dissolved and particulate metals are transported downstream. In general, where the creek widens into floodplains there is a tendency for surface water to discharge dissolved metals to groundwater and deposit suspended sediment onto the streambed.

As suspended or bedload particles are transported by the river system, there is a possibility that metals will desorb from the sediments and enter the river in the dissolved phase. Furthermore, metals may enter the river from riverbank porewater. During high flow events, riverbanks and adjacent floodplain areas store water. The stored pore water can increase in concentration as metals desorb from sediments or as precipitated solid phases and minerals dissolve. As the waters subside, these dissolved metals reenter the river system and are transported.

Sediment derived in Pine Creek is transported to the South Fork. Likely sediment sources in Pine Creek include mining wastes and tailings, rock debris situated adjacent to channels, mobilization of channel bed sediment, and bank erosion. Based on USGS sediment transport and stream discharge data, approximately 2,900 tons of sediment was transported past the USGS gage station on Pine Creek during water year 1999. With a drainage area of approximately 77 square miles, the total suspended sediment yield for water year 1999 was approximately 12 tons per year per square mile. Of that, approximately 7 tons was sand and 5 tons was fines. A total of approximately 900 tons of suspended sediment was transported past the Pine Creek gage in water year 1999. Annual bedload sediment yield was approximately 26 tons per year per square mile for Pine Creek in water year 1999 for a total of about 2,000 tons.

Suspended sediment and bedload samples were not analyzed for total metals; therefore mass loading was estimated from total and dissolved surface water data as described in Section 5.2.

5.3.2 Segment Descriptions

Segment PineCrkSeg01 has approximately 28,000 feet (5.3 miles) of mapped channel. Through this section, Pine Creek flows through a valley bottom typically 200 to 300 feet wide. In areas, the channel appears to be confined by hillslopes. Channel slope varies from 1 to 8 percent. In general the valley bottom is unvegetated and consists of river gravel. Evidence of relict channels and migration are abundant through this segment. Several cuts, mines and tailings deposits are situated adjacent to the channel within this segment. Likely sediment sources in this segment are apparently from the cuts, mines, and tailings deposits, lateral migration, and channel bed remobilization. Metals concentrations in soil and sediment samples exceeded screening levels for eight of the ten COPCs. Concentrations of arsenic, lead, and zinc exceeded 10x the screening level.

Segment PineCrkSeg2 contains the headwaters of Pine Creek (including the West Fork of Pine Creek) up to its confluence with the East Fork. Aerial photographs were not available for review of this segment; therefore, detailed channel descriptions were not generated for this report. The BLM identified 30 source areas in this segment. The majority of these are small, undeveloped prospects or mines. No tailings deposits are present and this segment is thought not to be a significant contributor of mine-waste impacted sediment to the Pine Creek Watershed. The BLM has excavated and removed mining wastes in this segment.

Segment PineCrkSeg03 has approximately 27,000 feet (5.1 miles) of mapped channel. Channel slope ranges from 0.5 to 1.5 percent. Likely sediment sources in segment PineCrkSeg03 are mine tailings and wastes, channel bed remobilization, minor bank erosion, lateral migration and possibly rock debris piles adjacent to the stream. Soil and sediment metals concentrations exceeded screening levels, especially cadmium, lead, and zinc. Metals concentrations in soil and sediment samples exceeded screening levels for seven of the ten COPCs.

5.3.3 Summary of Sediment Transport

Approximately 2,900 tons of sediment was transported from Pine Creek to the South Fork in water year 1999. Sediment sources occur in segments PineCrkSeg01 and PineCrkSeg03 and include channel bed remobilization, mine tailings and wastes, minor bank erosion, lateral migration and rock debris piles adjacent to the stream. Though suspended and bedload sediment samples were not collected and analyzed for metals, suspended and bedload sediment concentrations may be represented by metals concentrations reported for soil and sediment samples collected in Pine Creek. As presented in Section 4.1, Nature and Extent, metals concentrations in soil and sediment samples exceeded screening levels, especially for antimony, arsenic, cadmium, lead, and zinc.

5.4 SUMMARY OF FATE AND TRANSPORT IN PINE CREEK

The probabilistic model was used to quantify and summarize the available data and to estimate pre-remediation metals concentrations in surface water and mass loading to Pine Creek. Sediment transport was evaluated using USGS suspended and bedload sediment discharge data and measured soil and sediment data. Results are summarized in this section.

Surface water discharge, metals concentrations (total and dissolved), and mass loading data were analyzed using lognormal PDFs at three separate sampling locations in Pine Creek. The data were also standardized location by location and PDFs were developed from the aggregated data for Pine Creek as a whole. Only results for cadmium, lead, and zinc were analyzed. Regressions were developed for total and dissolved concentrations versus discharge to quantify and identify trends in concentrations and mass loading with changing discharge rates. The percentages of dissolved and particulate forms of metals were computed from the estimated expected values predicted by the model.

Results of the probabilistic modeling indicate:

- The screening level for dissolved zinc (42 µg/l) is exceeded at all three sampling locations. At sampling location PC308, the estimated expected dissolved concentration exceeded the screening level by more than 100-fold. The 90th percentile TMDL for dissolved zinc loads (67.4 pounds/day) is exceeded at sampling locations PC308 and PC305.

- The screening level for total lead concentrations is not exceeded at any of the sampling locations. The total lead load exceeds the lead TMDL at sampling location PC305, located at the mouth of Pine Creek.

- The screening level for dissolved cadmium was exceeded at all three sampling locations. The estimated cadmium load exceeded the 90th percentile TMDL for dissolved cadmium loads at the mouth of Pine Creek.

- Dissolved zinc and cadmium and total lead concentrations increased with increasing discharge.

- Potential major source areas identified in each reach are listed in Table 5.4-1. Time-critical removal actions conducted by the Bureau of Land Management (BLM) in 1996-1997 include removal of tailings from Amy-Matchless millsite, Liberal King millsite, and the Denver tailings. Additional actions have been proposed or are ongoing at the Amy-Matchless millsite, the Liberal King millsite, the Nabob millsite, the Denver Creek tailings, the Sidney millsite (on Red Cloud Creek), the Highland Surprise millsite, and the Upper Constitution millsite (BLM 1998).

Rehabilitation has been conducted or is ongoing at the major potential metals loading sources. Monitoring should be conducted to assess the effectiveness of the removal actions; therefore, no sites have been identified for detailed analysis/mapping in the FS at this time.

To illustrate the observed trends of estimated expected values throughout the watershed, estimated expected values for cadmium, lead, and zinc concentrations and mass loading are shown in Figures 5.4-1 through 5.4-6. To illustrate the relationship between discharge, concentration, and mass loading, estimated expected values for these variables at each sampling location are plotted together for cadmium, lead, and zinc in Figures 5.4-7 through 5.4-9, respectively.

Bureau of Land Management (BLM). 1998. *Information Sheet No. 3 Pine Creek Mill Sites*. Executive Summary of the Final Engineering Evaluation/Cost Analysis Report. Shoshone County, Idaho. August 1998.

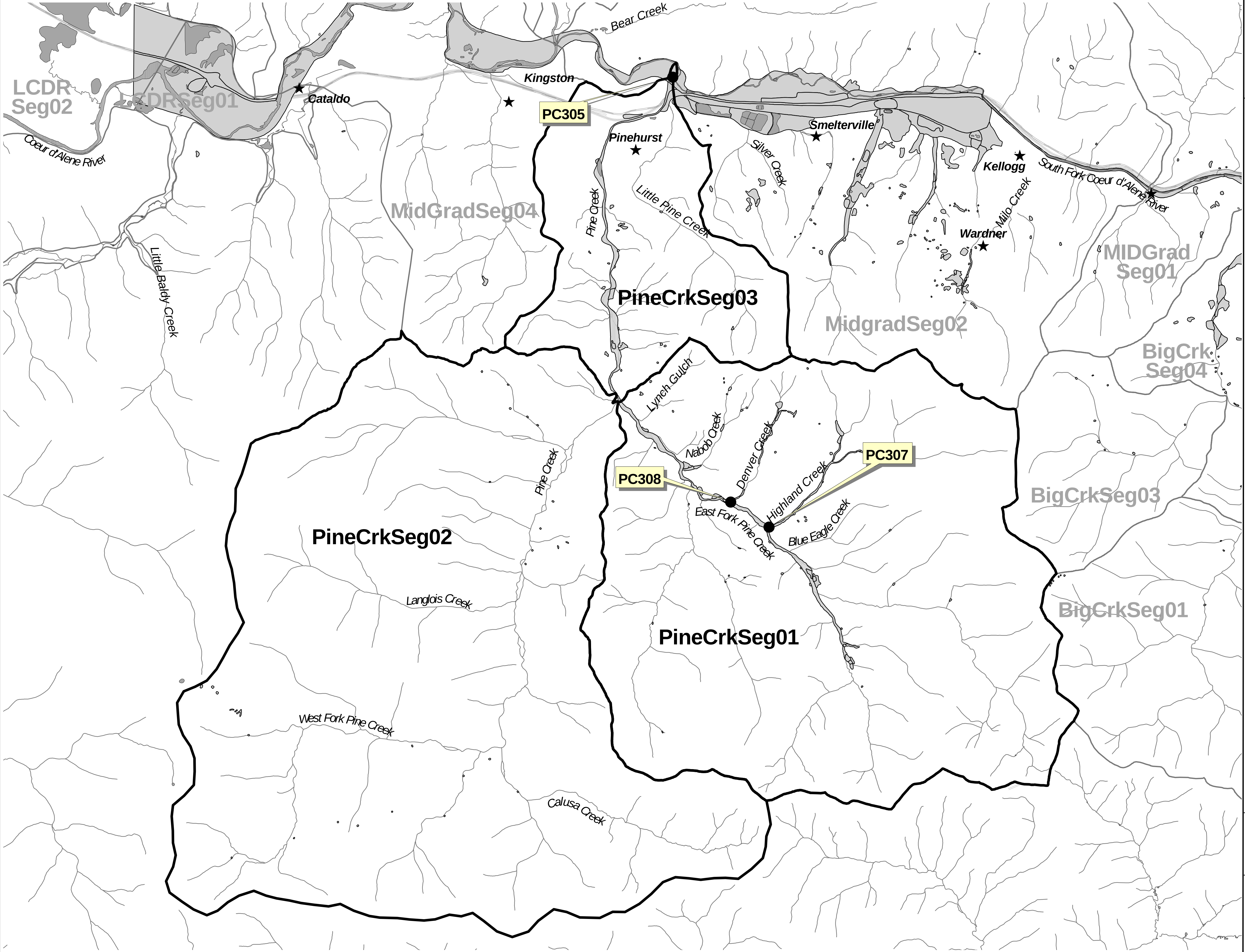
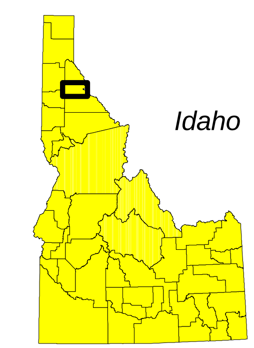


Figure 5.2-1
Pine Creek Watershed
Sampling Locations Evaluated in Probabilistic Modeling

LEGEND

- Sampling Location
- Stream
- Interstate 90
- City
- Pine Creek Watershed
- Pine Creek Segment
- River Segment
- Lake/River
- Source Area



Location Map

NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.

SCALE 1:80,000

0.5 0 0.5 Miles

N

027-RI-C0-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

EPA REGION 10

Document Control 4162500.6615.05a
Generation 1
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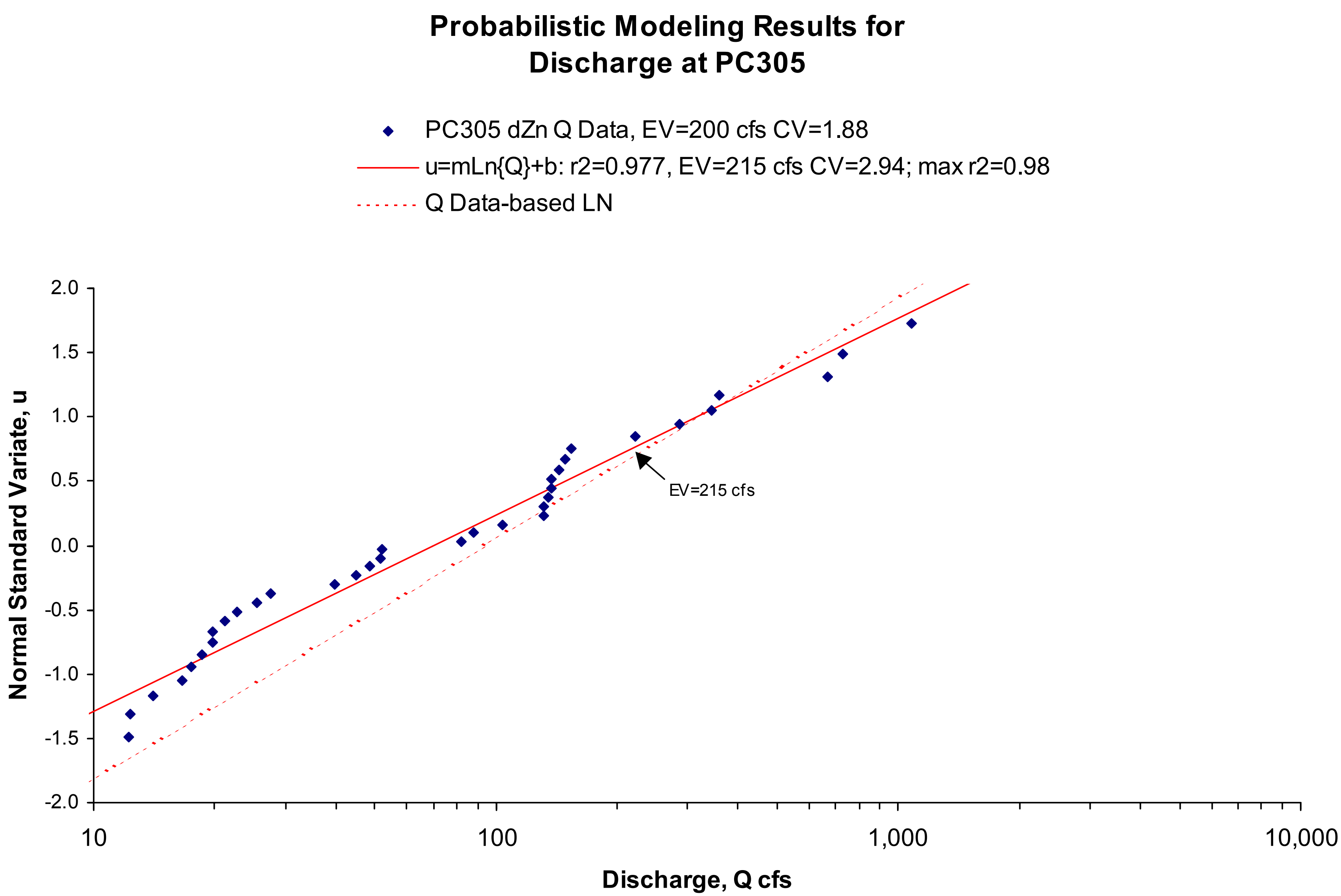
V:tZn Mass Loading
E:tZn
L: Final RI Sample Locate
7/13/2001

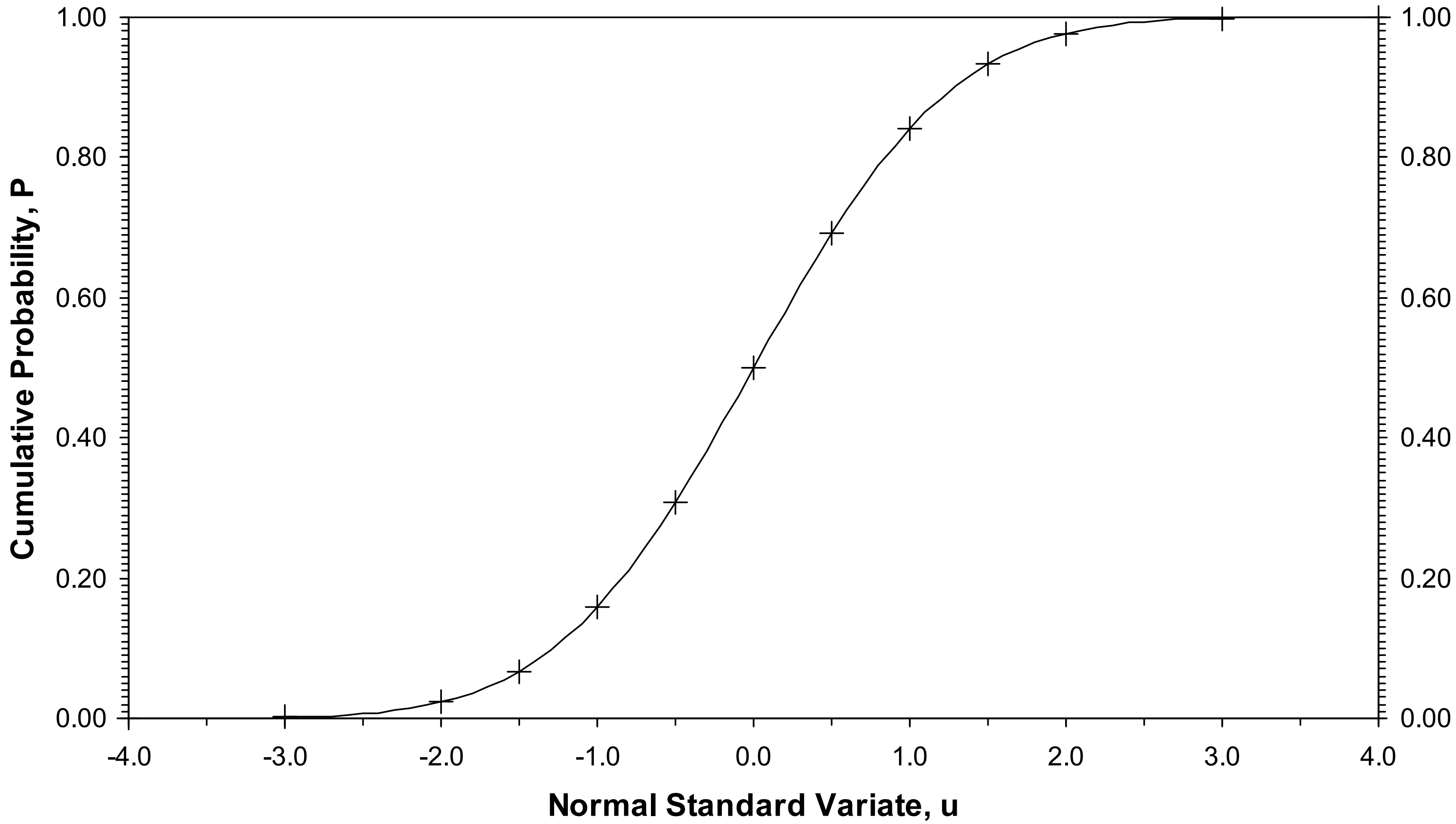
This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: JUIY 13, 2001

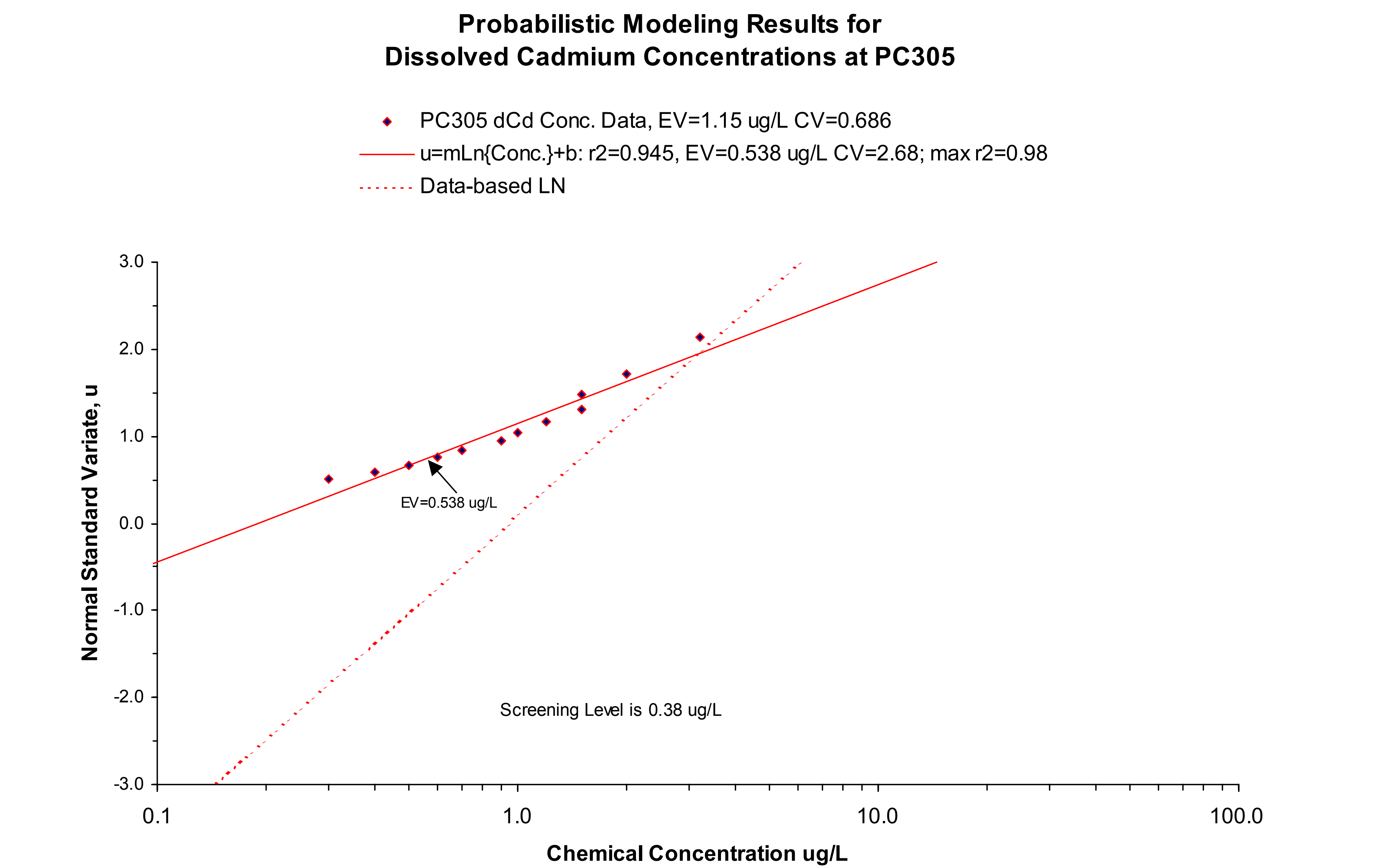


EPA REGION 10	027-RI-CO-102Q Coeur d'Alene Basin RI/FS RI REPORT	Doc Control: 4162500.6615.05.a Generation: 1 Pine Creek Series 07/13/01	**Figure 5.2-2**

Cumulative Probability Values Corresponding to Normal Standard Variate Values

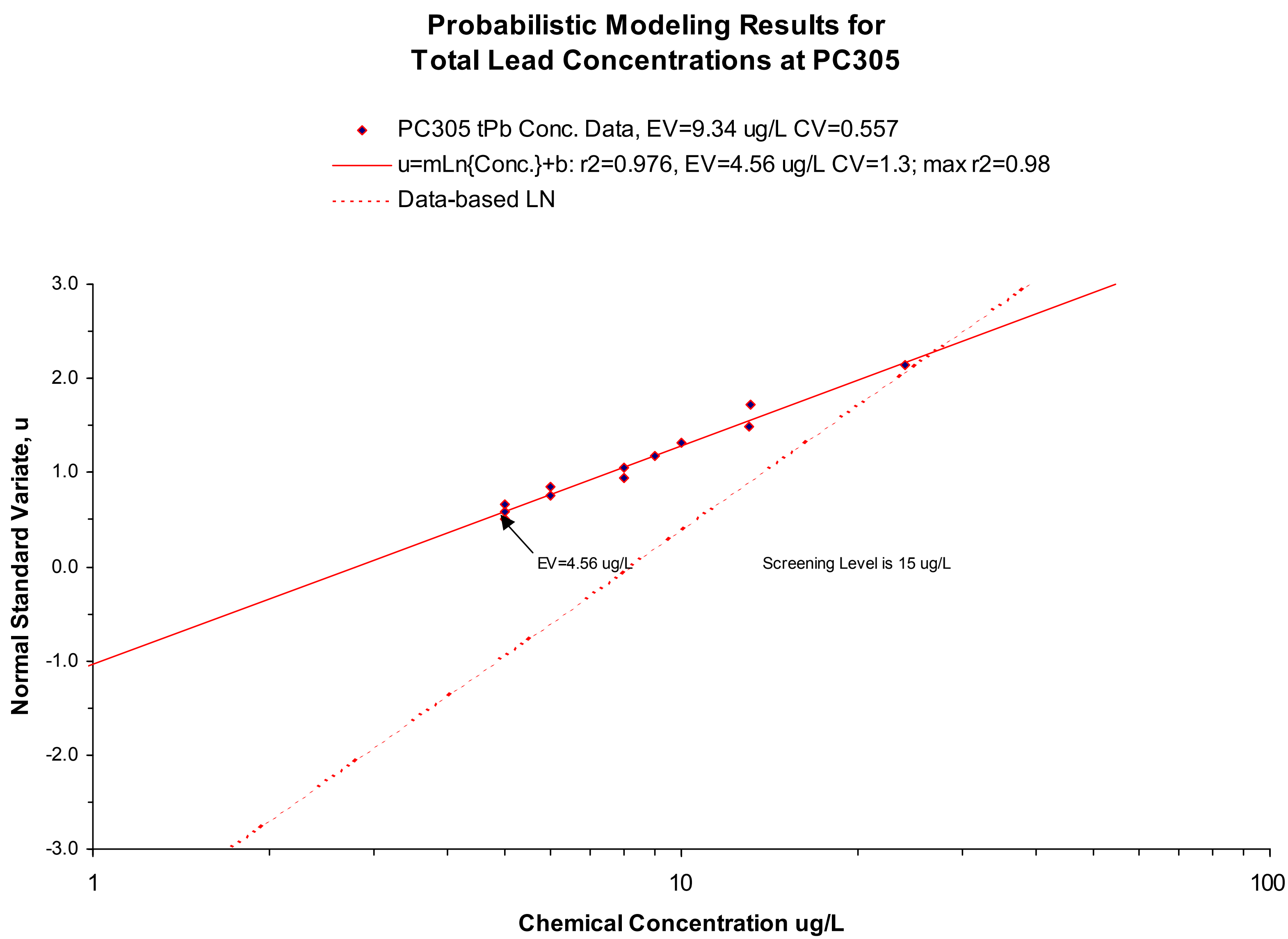


EPA REGION 10	027-RI-CO-102Q Coeur d'Alene Basin RI/FS RI REPORT	Doc Control: 4162500.6615.05.a Generation: 1 Pine Creek Series 07/13/01	**Figure 5.2-3**



Probabilistic Modeling Results for
Dissolved Cadmium Concentrations at PC305
PC305 dCd Conc. Data, EV=1.15 ug/L CV=0.686
u=mLn{Conc.}+b: r2=0.945, EV=0.538 ug/L CV=2.68; max r2=0.98
Data-based LN
EV=0.538 ug/L
Screening Level is 0.38 ug/L
Normal Standard Variate, u
3.0
2.0
1.0
0.0
-1.0
-2.0
-3.0
0.1
1.0
10.0
100.0
Chemical Concentration ug/L

Figure 5.2-4



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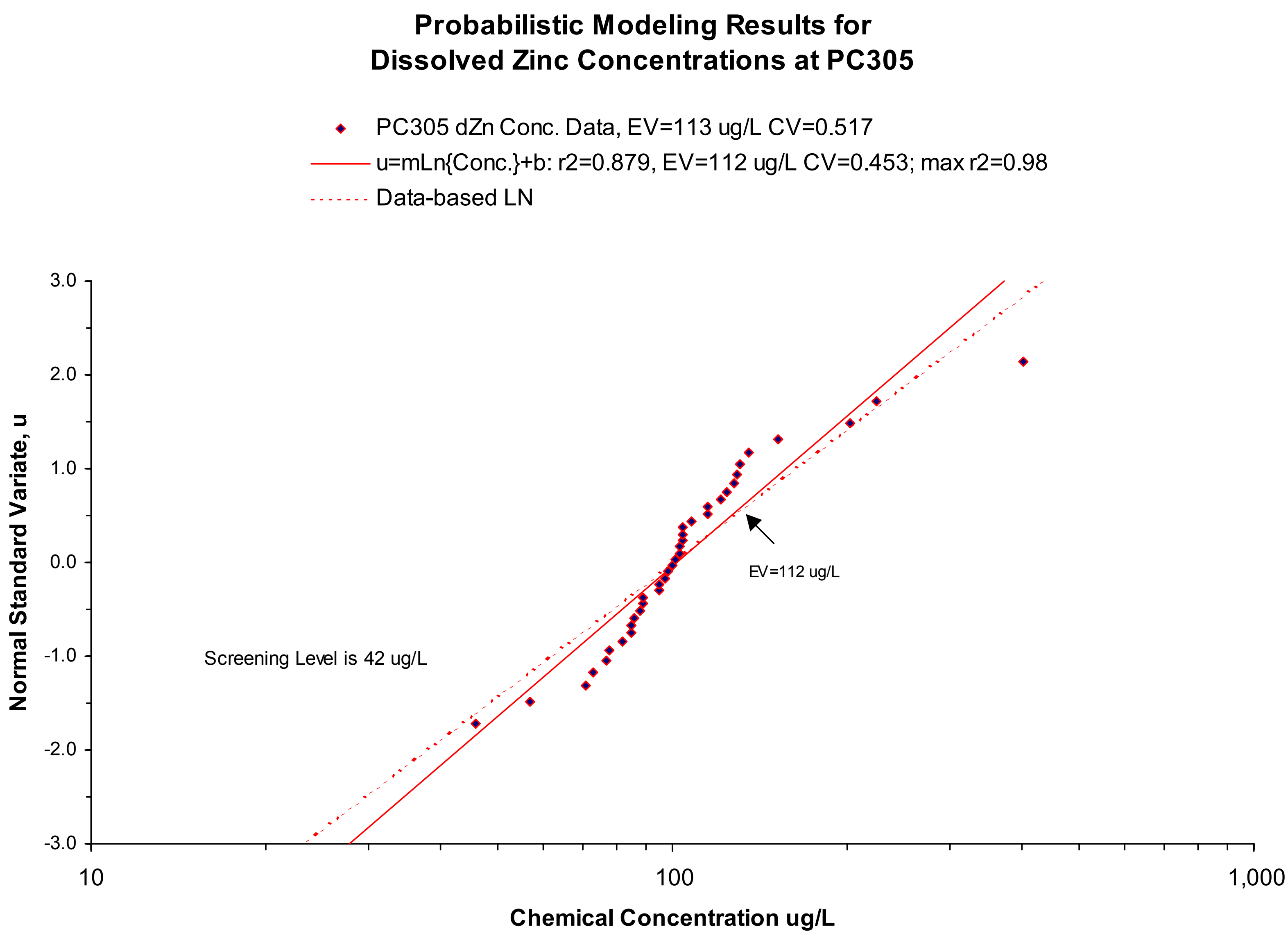
027-RI-CO-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

Doc Control: 4162500.6615.05.a
Generation: 1

Pine Creek Series
07/13/01

Figure 5.2-5



EPA REGION 10

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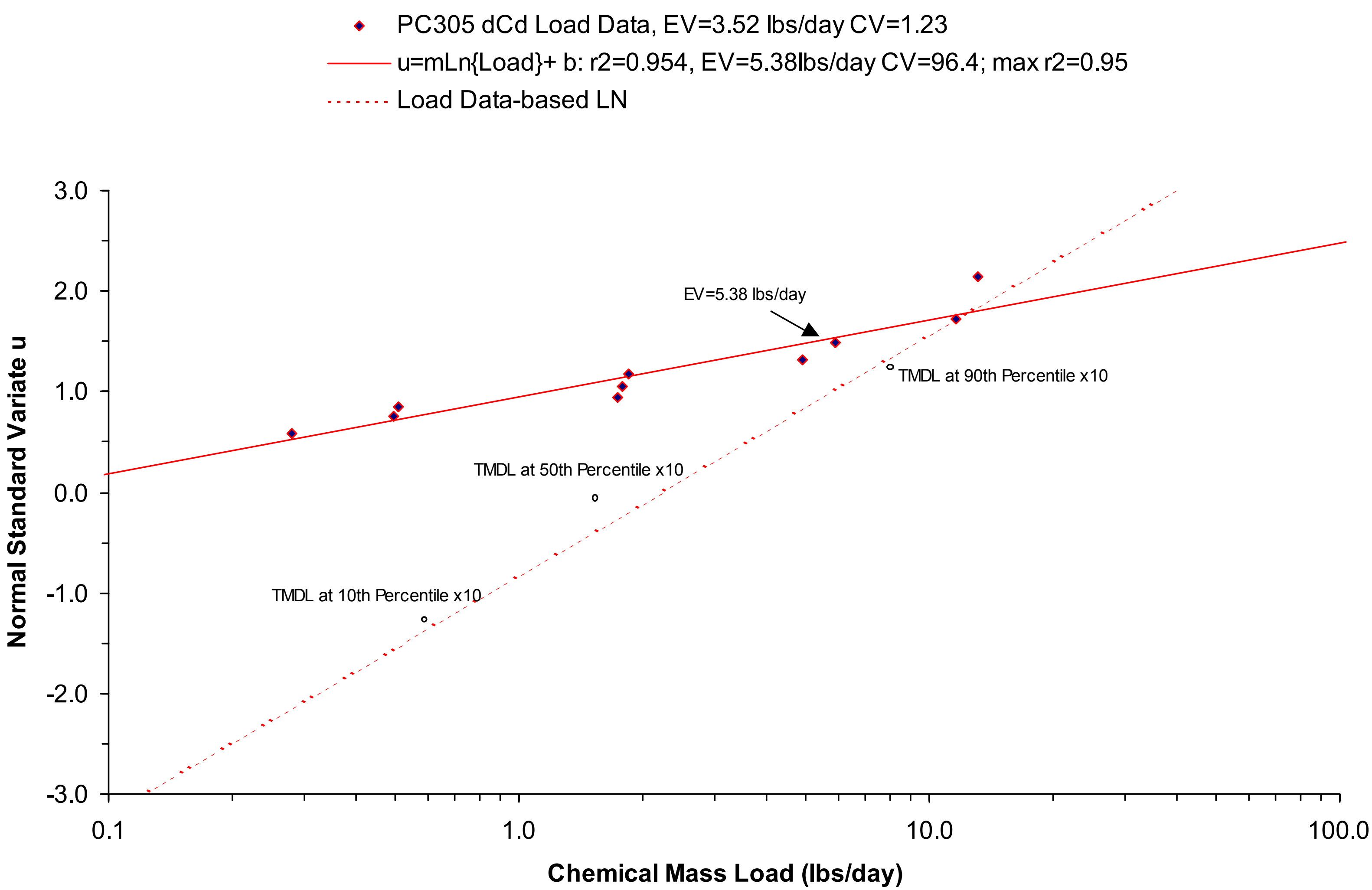
Coeur d'Alene Basin RI/FS
RI REPORT

Doc Control: 4162500.6615.05.a
Generation: 1

Pine Creek Series
07/13/01

Figure 5.2-6

Probabilistic Modeling Results for Dissolved Cadmium Mass Loading at PC305



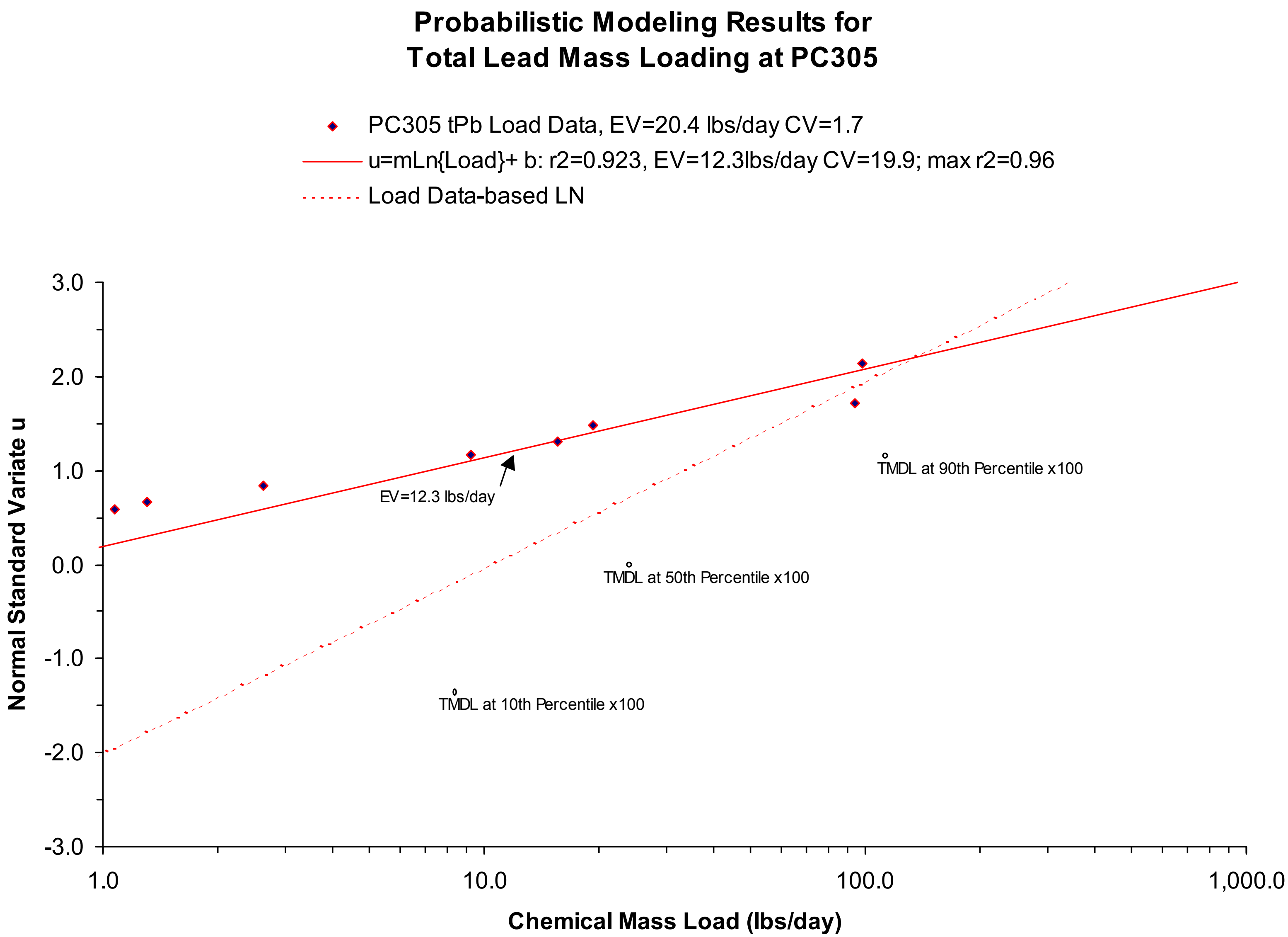
EPA REGION 10

027-RI-CO-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

Doc Control: 4162500.6615.05.a
Generation: 1

Pine Creek Series
07/13/01

Figure 5.2-7



EPA REGION 10

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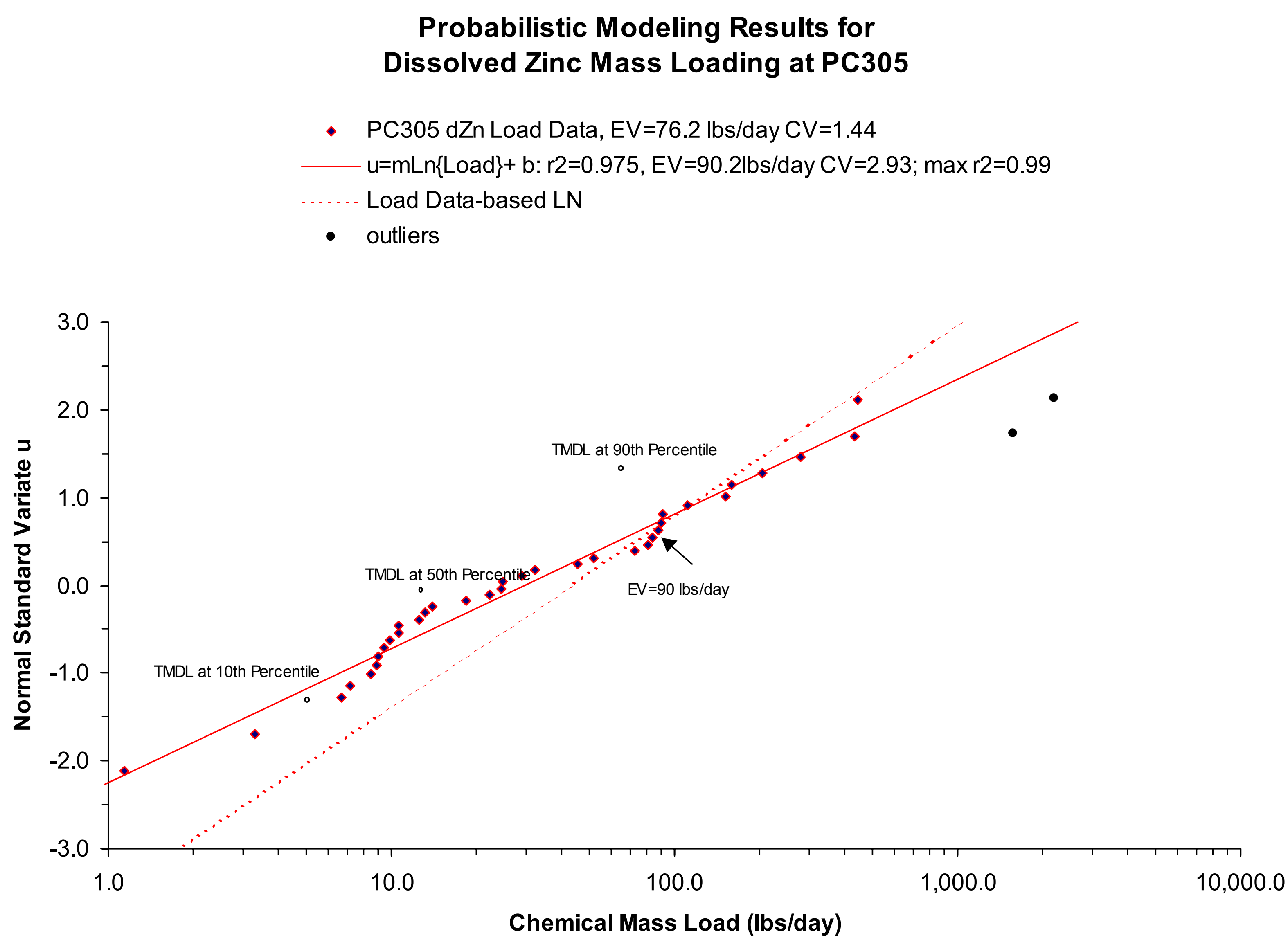
Coeur d'Alene Basin RI/FS
RI REPORT

Doc Control: 4162500.6615.05.a
Generation: 1

Pine Creek Series
07/13/01

Figure 5.2-8



EPA REGION 10

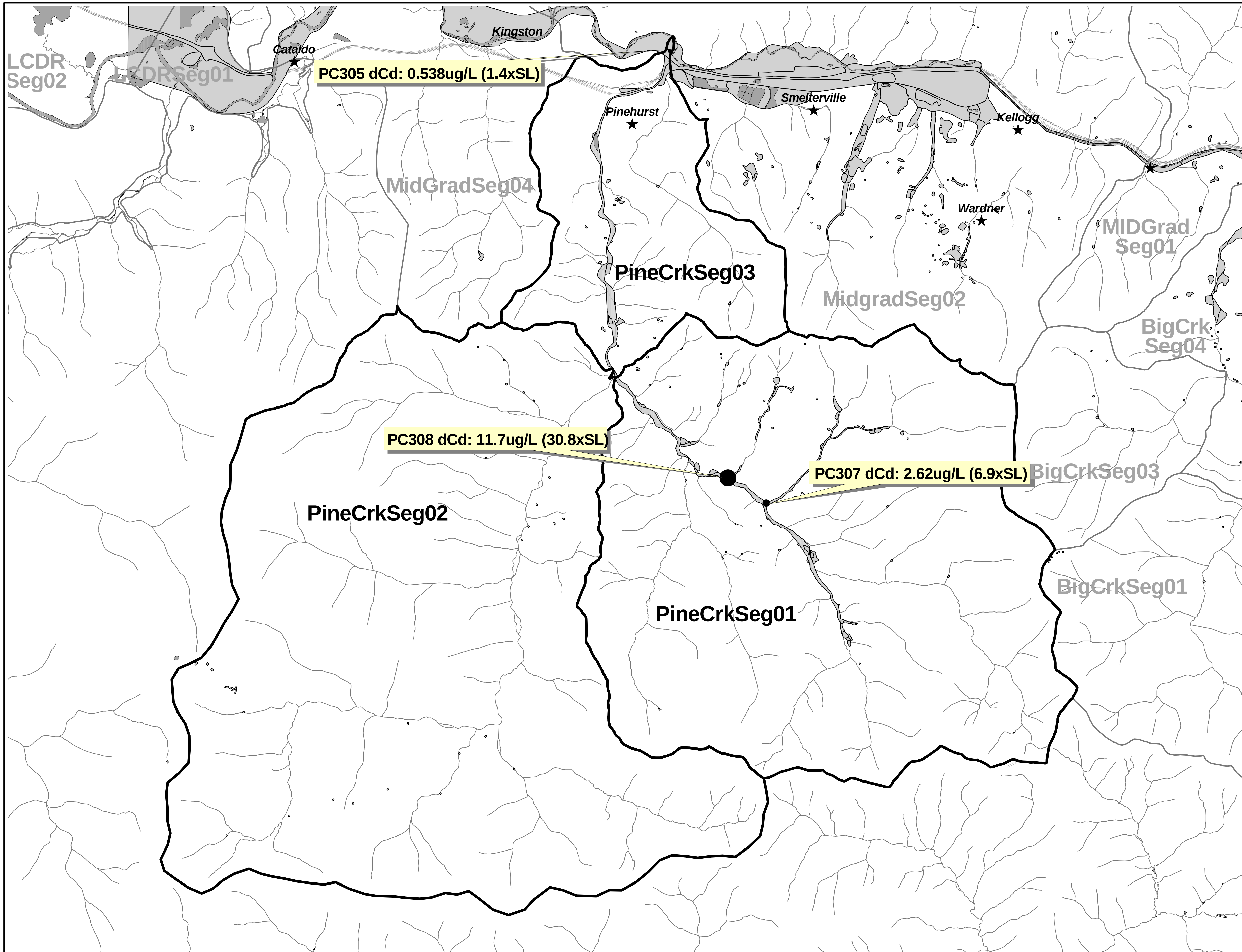
027-RI-CO-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

Doc Control: 4162500.6615.05.a
Generation: 1

Pine Creek Series
07/13/01

Figure 5.2-9

Figure 5.4-1
Pine Creek Watershed Estimated Expected Values for Dissolved Cadmium Concentrations



LEGEND

Sampling Location — Concentration

PC307 dCd: 2.62ug/L (6.9xSL)

Analyte — Screening Level is 0.38ug/L

Range of Dissolved Cadmium Concentrations in ug/L
- Range 0 - 2.5
- Range 2.5 - 5
- Range 5 - 10
- Range 10 - 15
- Range >15

- Stream
- Interstate 90
- City
- Pine Creek Watershed
- Pine Creek Segment
- River Segment
- Lake/River
- Source Area

Idaho

NOTES

Location Map

NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.

SCALE 1:80,000

0.5 0 0.5 Miles

N

027-RI-C0-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

EPA REGION 10

Document Control 4162500.6615.05.a
Generation 1
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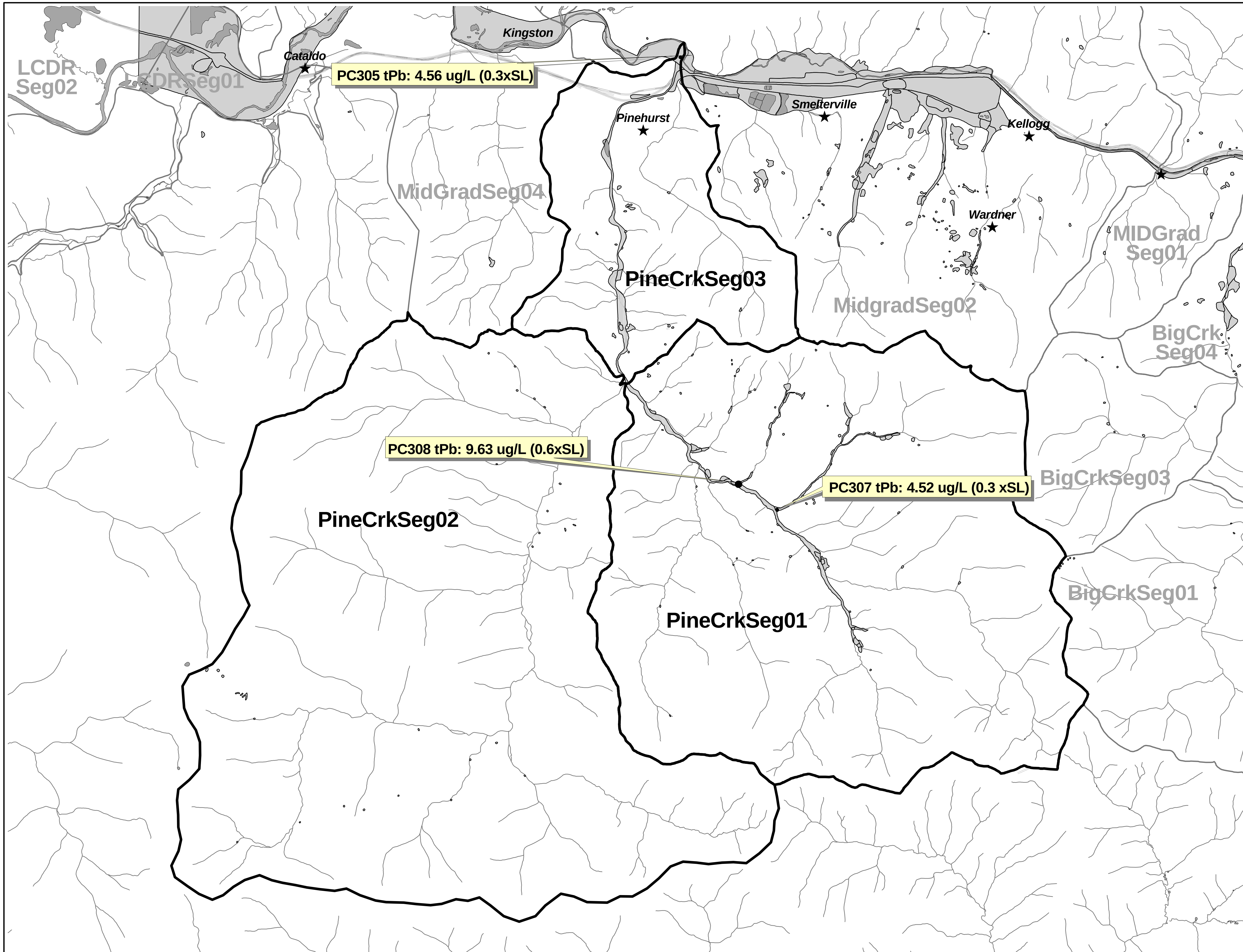
|pine_creek_ev7-13.apr
V:dCd PC concentrations
E:dCd
L: Final RI dCd Concentrations
7/13/2001

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: July 17, 2001

Figure 5.4-2
Pine Creek Watershed Estimated Expected Values for Total Lead Concentrations



LEGEND

Sampling Location — Concentration

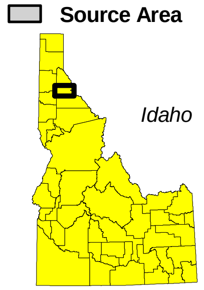
PC307 tPb: 4.52ug/L (0.3xSL)

Analyte — Screening Level is 15 ug/L

Range of Total Lead Concentrations in ug/L

- Range 0 - 5
- Range 5 - 10
- Range 10 - 50
- Range 50 - 100
- Range >100

- Stream
- Interstate 90
- City
- Pine Creek Watershed
- Pine Creek Segment
- River Segment
- Lake/River
- Source Area



Location Map

NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.

SCALE 1:80,000

0.5 0 0.5 Miles

027-RI-C0-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

EPA REGION 10

Document Control 4162500.6615.05.a
Generation 1
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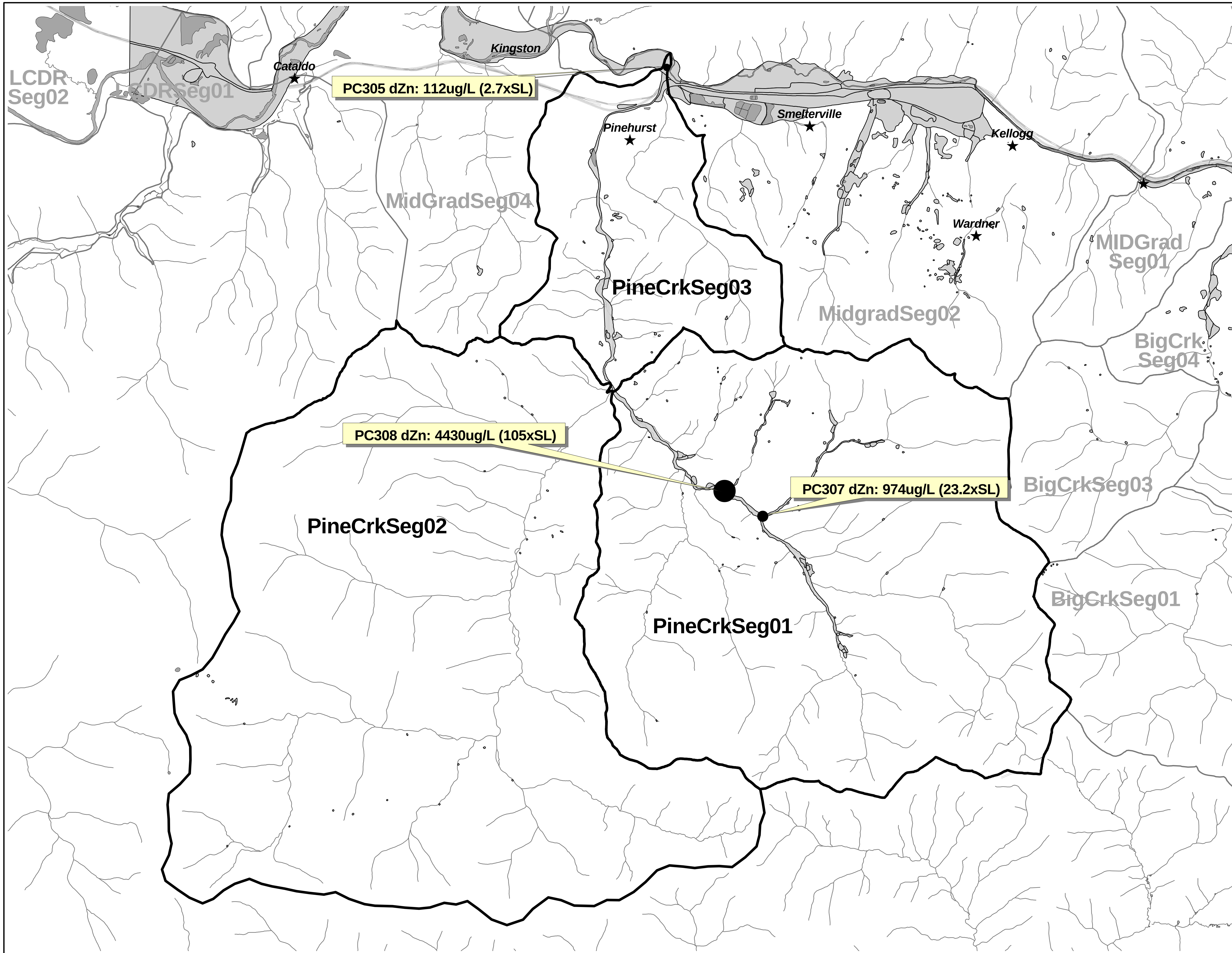
V:tPb concentrations
E:tPb
L: Final RI tPb Concentrations
7/16/2001

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: July 16, 2001

Figure 5.4-3
Pine Creek Watershed Estimated Expected Values for Dissolved Zinc Concentrations



LEGEND

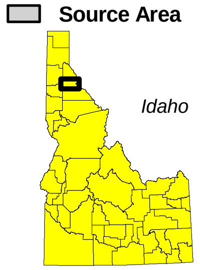
Sampling Location — Concentration

PC307 dZn: 974ug/L (23.2xSL)

Analyte — Screening Level is 42 ug/L

Range of Dissolved Zinc Concentrations in ug/L
- Range 0 - 100
- Range 100 - 500
- Range 500 - 1000
- Range 1000 - 1500
- Range >1500

- Stream
- Interstate 90
- City
- Pine Creek Watershed
- Pine Creek Segment
- River Segment
- Lake/River
- Source Area



Location Map

NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.

SCALE 1:80,000

0.5 0 0.5 Miles

N

027-RI-C0-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

EPA REGION 10

Document Control 4162500.6615.05.a
Generation 1
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V:dZn concentrations
E:dZn
L: Final RI dZn concentrations
7/16/2001

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: July 16, 2001

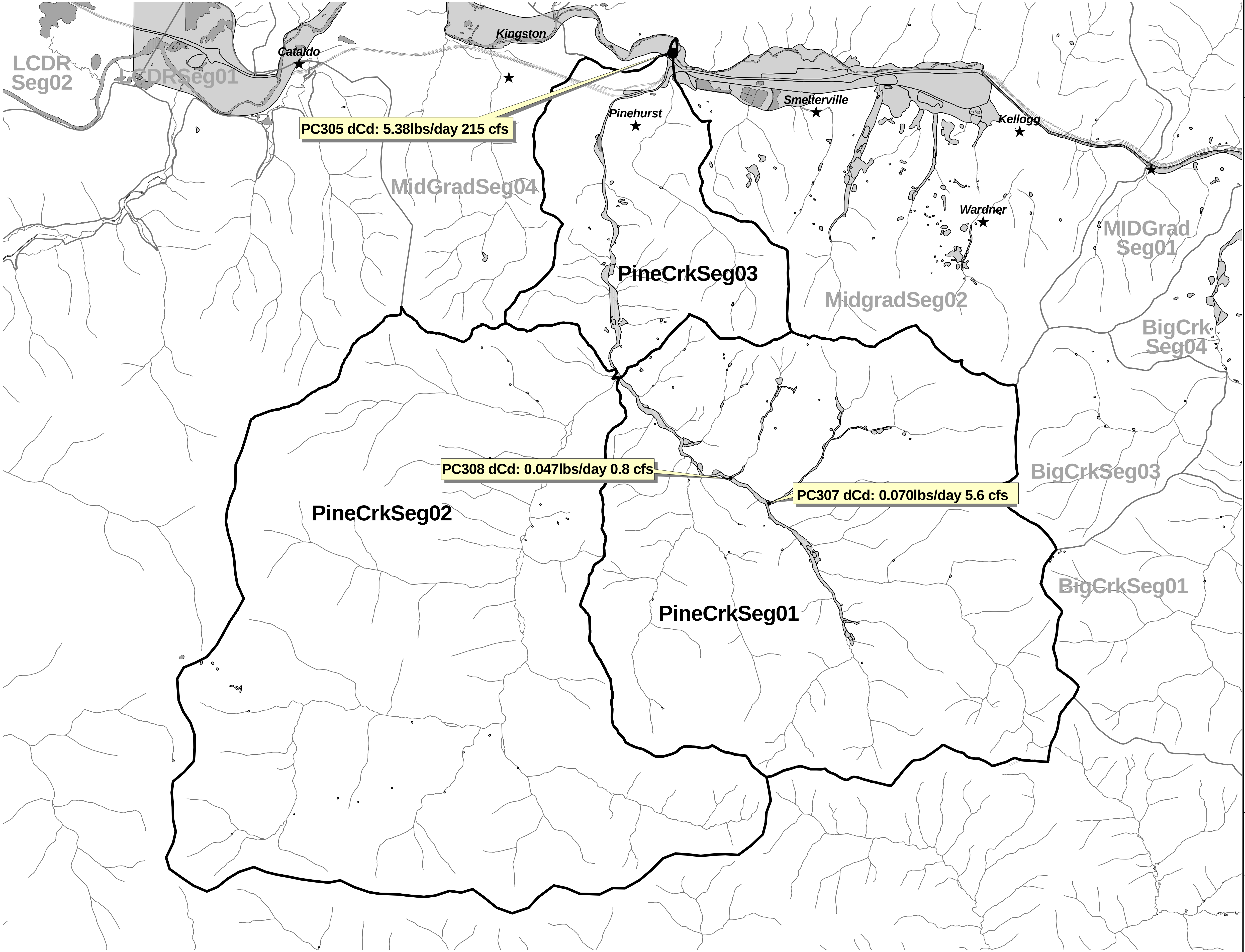


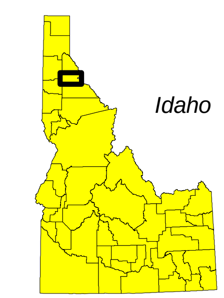
Figure 5.4-4
Pine Creek Watershed Estimated Expected Values for Dissolved Cadmium Mass Loading

LEGEND

Sampling Location
Mass Load
PC307 dCd: 0.1lbs/day 5.6 cfs
Analyte
Flow in Cubic Feet per Second

Range of Total Cadmium Mass Loading in lbs/day
- Range 0 - 2.5
- Range 2.5 - 5
- Range 5 - 10
- Range 10 - 15
- Range >15

- Stream
- Interstate 90
- City
- Pine Creek Watershed
- Pine Creek Segment
- River Segment
- Lake/River
- Source Area



Location Map

NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.

SCALE 1:80,000

0.5 0 0.5 Miles

N

027-RI-C0-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

EPA REGION 10

Document Control 4162500.6615.05a
Generation 1
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pine_creek_ev7-13.apr
V:tCd Mass Loading
E:tCd
L: Final RI dCd Mass Loading
7/16/2001

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: July 16, 2001

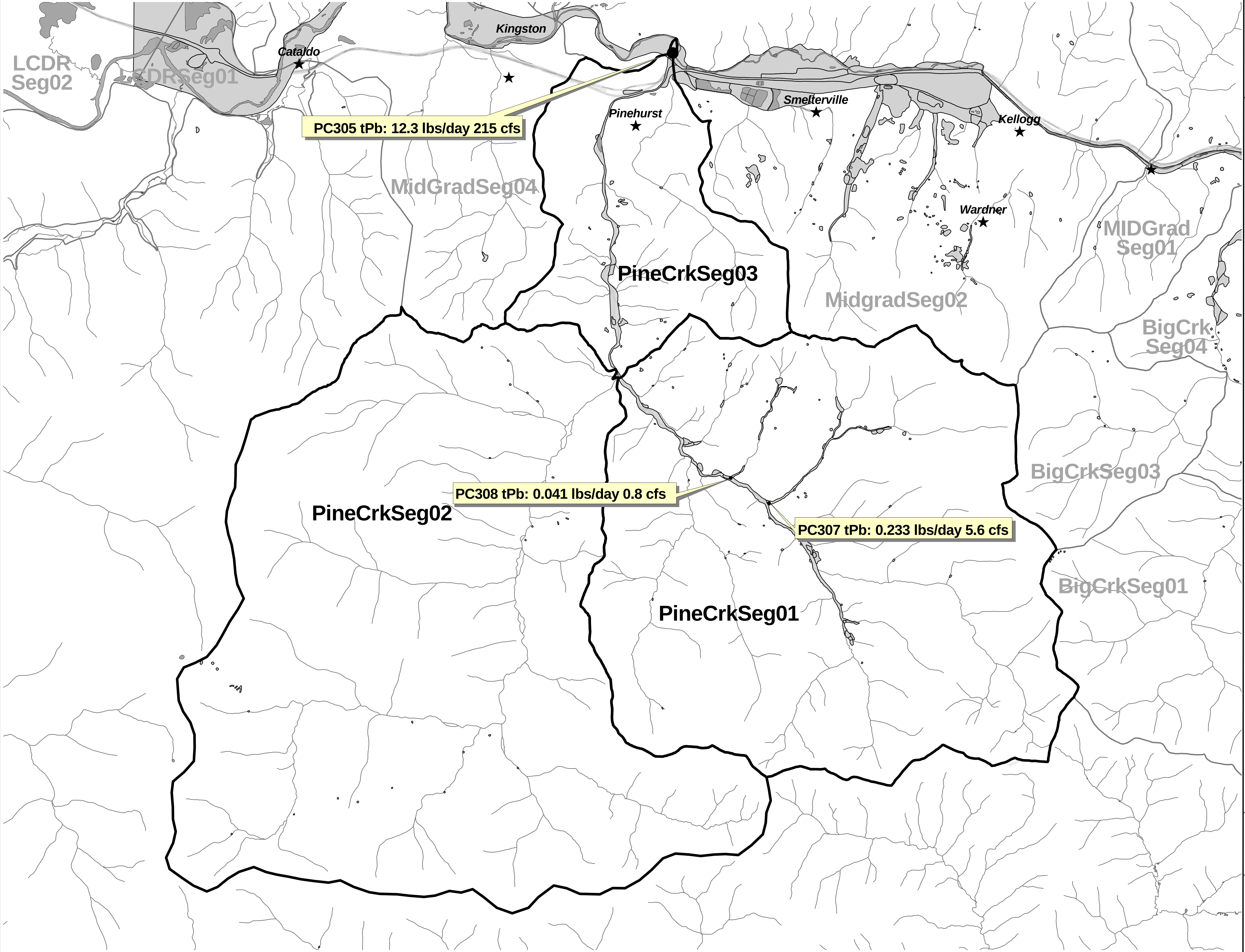


Figure 5.4-5
Pine Creek Watershed
Estimated Expected Values for Total Lead Mass Loading

LEGEND

Sampling Location

Mass Load

PC307 tPb: 0.2lbs/day 5.6 cfs

Analyte

Flow measured in Cubic Feet per Second

Range of Total Lead Mass Loading in lbs/day

- Range 0 - 5
- Range 5 - 10
- Range 10 - 50
- Range 50 - 100
- Range >100

Stream

Interstate 90

City

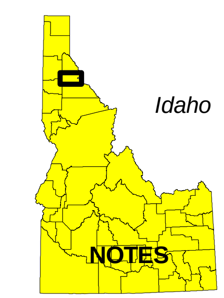
Pine Creek Watershed

Pine Creek Segment

River Segment

Lake/River

Source Area



Location Map

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.

SCALE 1:80,000

0.5 0 0.5 Miles

N

027-RI-C0-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

EPA REGION 10

Document Control 4162500.6615.05a
Generation 1
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V:tPb massloading
E:tPb
L: Final RI tPb Massloading
7/16/2001

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: July 16, 2001

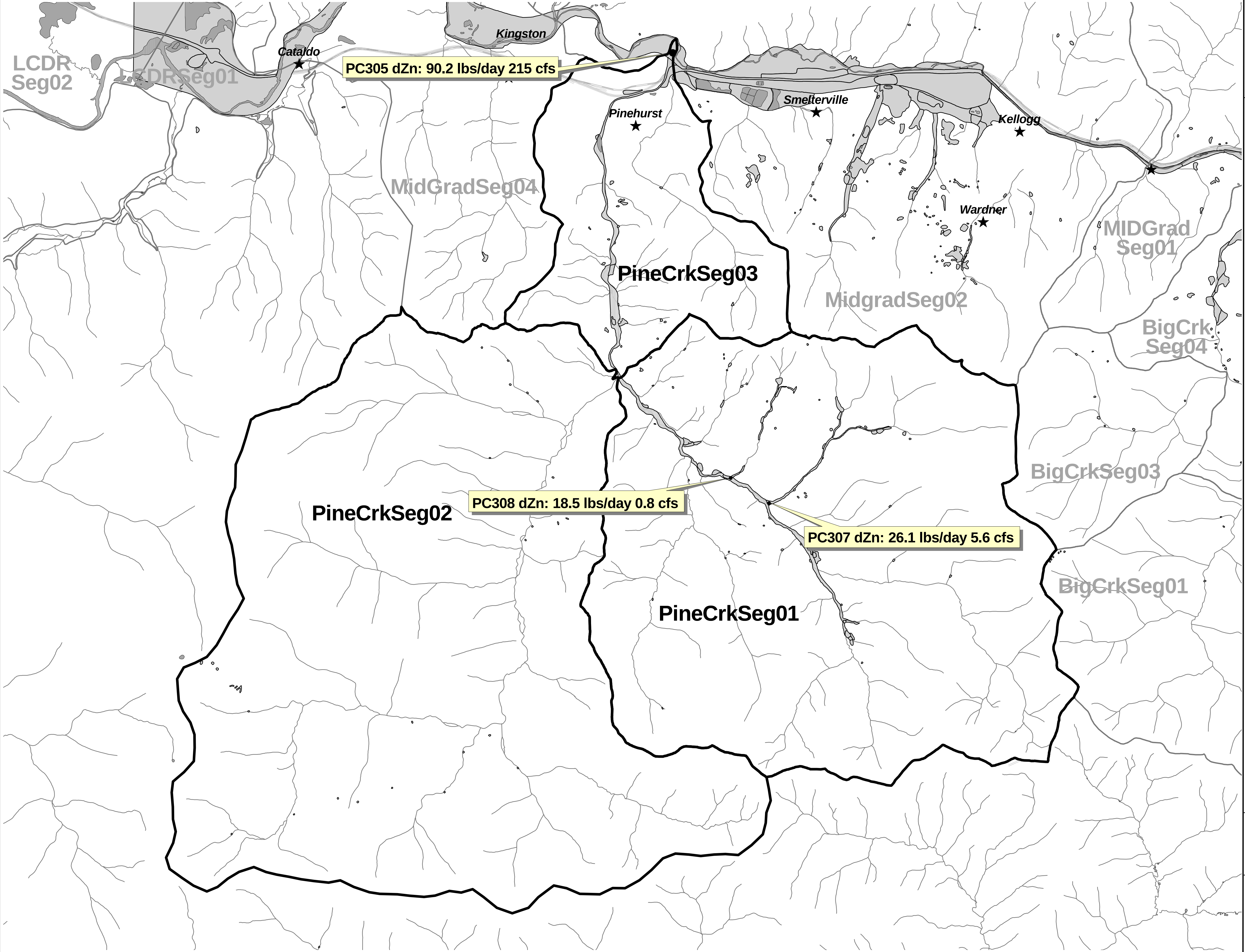


Figure 5.4-6
Pine Creek Watershed Estimated Expected Values for Dissolved Zinc Mass Loading

LEGEND

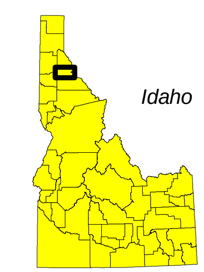
Sampling Location — Mass Load

PC307 dZn: 26.1lbs/day 5.6cfs

Analyte — Flow measured in Cubic Feet per Second

Range of Total Zinc Mass Loading in lbs/day

- Range 0 - 100
- Range 100 - 500
- Range 500 - 1000
- Range 1000 - 1500
- Range >1500
- Stream
- Interstate 90
- City
- Pine Creek Watershed
- Pine Creek Segment
- River Segment
- Lake/River
- Source Area



Location Map

NOTES

1) Base map coverages obtained from the Coeur d'Alene Tribe, URS Greiner Inc., CH2M HILL, and the Bureau of Land Management.

SCALE 1:80,000

0.5 0 0.5 Miles

N

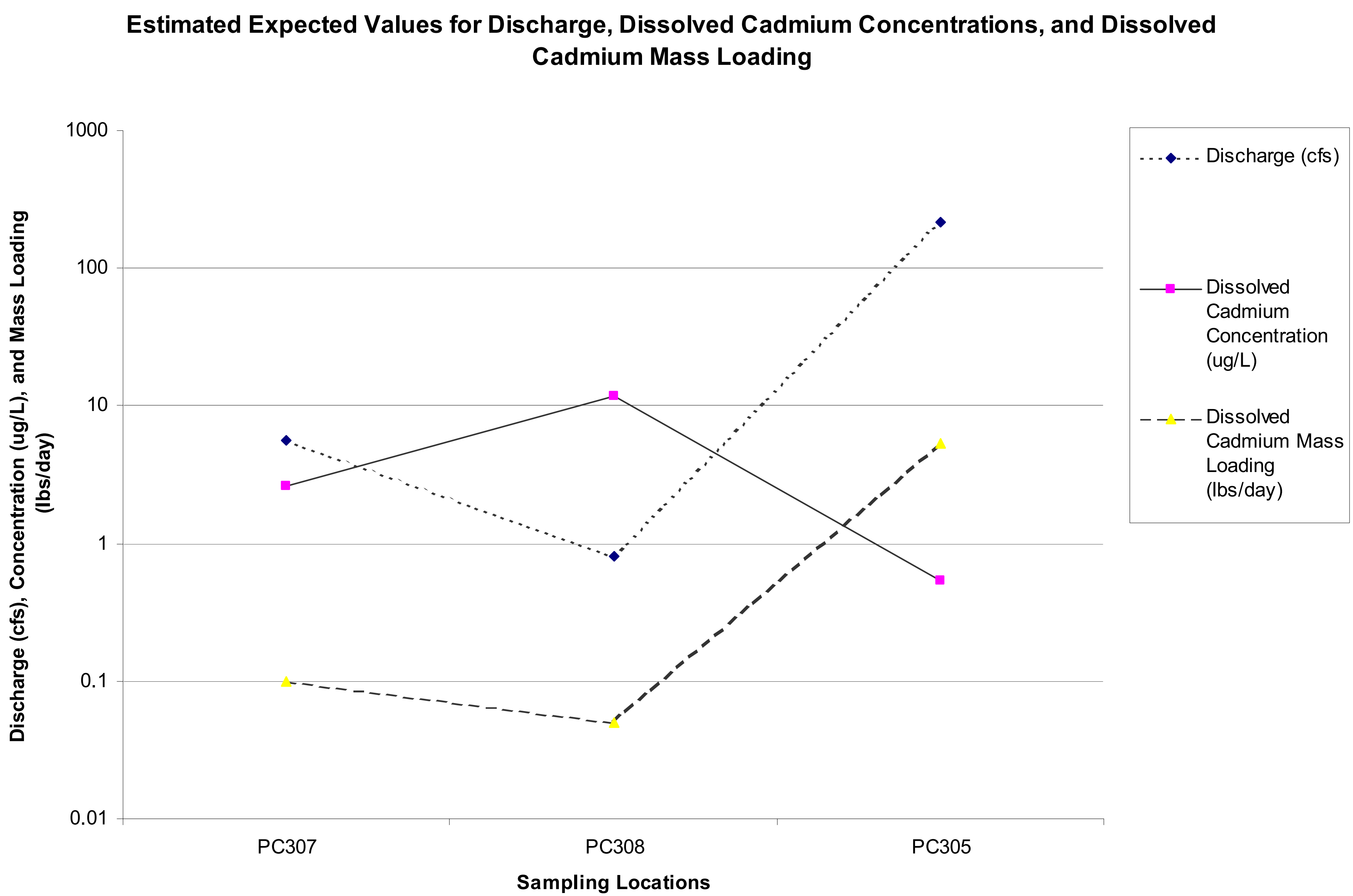
027-RI-C0-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

EPA REGION 10

Document Control 4162500.6615.05a
Generation 1
n:\Projects\watersheds\pine_wtrshd\
|pine_creek_ev7-13.apr
V:tZn Mass Loading
E:tZn
L: Final RI dZn Mass Loading
7/16/2001

This map is based on Idaho State Plane Coordinates West Zone, North American Datum 1983.

Date of Plot: July 16, 2001



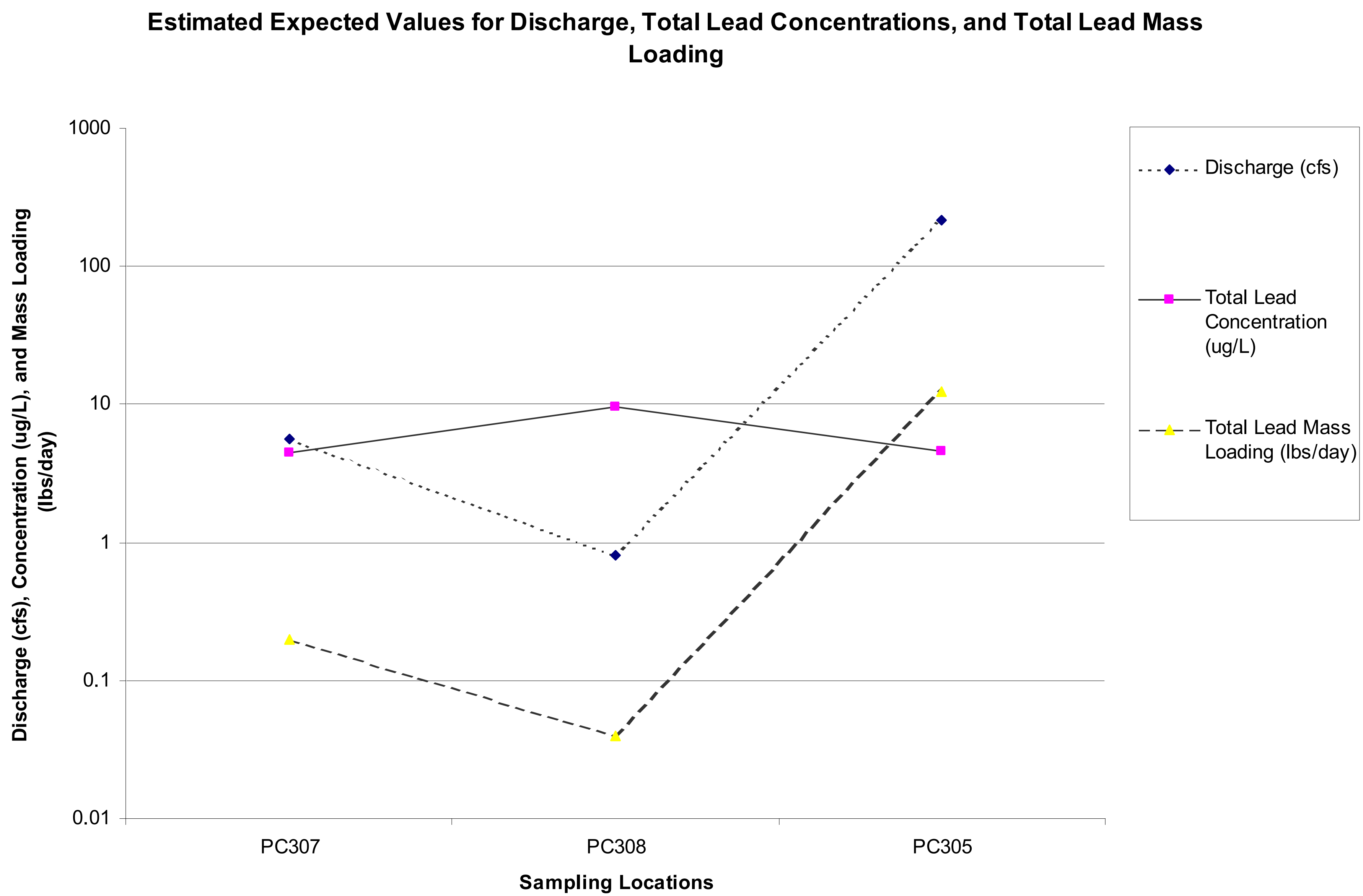
EPA REGION 10

027-RI-CO-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

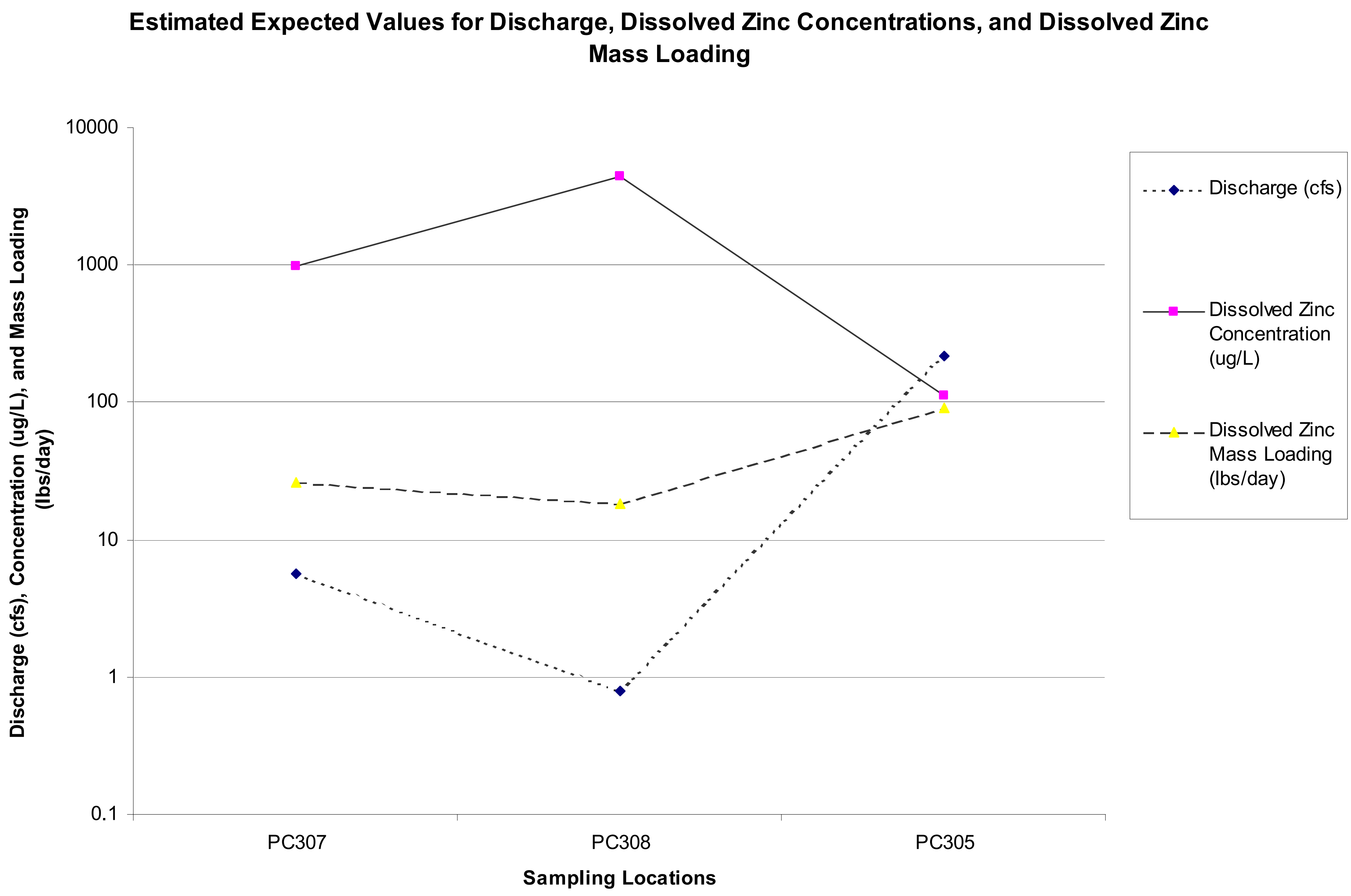
Doc Control: 4162500.6615.05.a
Generation: 1

Pine Creek Series
07/13/01

Figure 5.4-7



EPA REGION 10	027-RI-CO-102Q Coeur d'Alene Basin RI/FS RI REPORT	Doc Control: 4162500.6615.05.a Generation: 1 Pine Creek Series 07/13/01	**Figure 5.4-8**



EPA REGION 10

027-RI-CO-102Q
Coeur d'Alene Basin RI/FS
RI REPORT

Doc Control: 4162500.6615.05.a
Generation: 1

Pine Creek Series
07/13/01

Figure 5.4-9

Table 5.1-1
Low and High Instantaneous Metal Loading Values for Six Sampling Events From May 1991 to May 1999

Metal	Low (pounds/day)	High (pounds/day)
Dissolved Cadmium	0.01	40.2
Total Lead	0.016	20,131
Dissolved Lead	0.05	274
Dissolved Zinc	0.27	5,806

Table 5.2-1
Summary of Estimated Expected Values for Metals Concentrations and Mass Loading[a]

Sampling Location	Concentration (µg/l)			Mass Loading (pounds/day)			Discharge (cfs)
	Dissolved Cadmium	Total Lead	Dissolved Zinc	Dissolved Cadmium	Total Lead	Dissolved Zinc	
Screening Level or TMDL[b]	0.38	15	42	0.771	1.13	67.4	NA
PC307	**2.62** (0.211)	4.52 (1.19)	**974** (0.237)	0.070 (1.18)	0.233 (7.51)	26.1 (1.21)	5.6 (1.38)
PC308	**11.7** (0.273)	9.63 (0.535)	**4,430** (0.269)	0.047 (0.923)	0.041 (1.36)	18.5 (0.991)	0.8 (0.94)
PC305	**0.538** (2.68)	4.56 (1.3)	**112** (0.45)	**5.38** (96.4)	**12.3** (19.9)	**90.2** (2.93)	215 (2.94)

[a]Summary tables with all modeling results are included in Appendix C.
[b]TMDLs listed are the 90th percentile.
NA Not applicable
Values in parentheses are coefficients of variation (cv)
cfs - cubic feet per second
Bold - indicates exceedance of screening level or TMDL

Table 5.2-2
Estimated Gains or Losses in Discharge in the Pine Creek Watershed

Reach - between location Xi and Xj (# of samples)	Estimated expected value of gain or loss (EV[X]) in discharge, cfs	Coefficient of variation (CV) for reach (pxi,xj = 0.9)
PC307 (39) to PC308	-4.8	1.5
PC308 (33) to PC305 (38)	214.2	2.9

Table 5.2-3
Estimated Gains or Losses for Dissolved Zinc Concentrations (µg/l) and Dissolved Load (pounds/day [#/day])

Reach - between location Xi and Xj (# of samples)	Estimated expected value of increase or decrease in the concentration of dissolved zinc (µg/l)	Estimated coefficient of variation (CV) for the dissolved zinc (pxi,xj = 0.9)	Estimated expected value of gain or loss in the dissolved zinc load (#/day)	Estimated coefficient of variation (CV) for the dissolved zinc load (pxi,xj = 0.9)
PC307 (39) to PC308	3,456	0.3	-7.6	2.2
PC308 (33) to PC305 (38)	-4,318	0.3	71.7	3.5

Table 5.2-4
Estimated Gains or Losses for Total Lead Concentrations (µg/l) and Total Load (pounds/day [#/day])

Reach - between location Xi and Xj (# of samples)	Estimated expected value of increase or decrease in the total concentration of lead (µg/l)	Estimated Coefficient of variation (CV) for total lead concentrations	Estimated expected value of gain or loss in the total lead load (#/day)	Estimated coefficient of variation (CV) for the total lead load
PC307 (39) to PC308	5.11	0.5	-0.192	8.9
PC308 (33) to PC305 (38)	-5.07	0.5	12.26	20.0

Table 5.2-5
Estimated Gains or Losses for Dissolved Cadmium Concentrations (µg/l) and Load (pounds/day [#/day])

Reach - between location Xi and Xj (# of samples)	Estimated expected value of increase or decrease in the concentration of dissolved cadmium (µg/l)	Estimated coefficient of variation (CV) for the dissolved cadmium (pxi,xj = 0.9)	Estimated expected value of gain or loss in the dissolved cadmium load (#/day)	Estimated coefficient of variation (CV) for the dissolved cadmium load (pxi,xj = 0.9)
PC307 (39) to PC308	9.08	0.3	-0.022	2.1
PC308 (33) to PC305 (38)	-11.16	0.2	5.33	97.2

Table 5.4-1
Potential Major Source Areas in Pine Creek Watershed

Reach	Location Description	Associated Source Areas
Upstream of PC307	Upstream of the confluence of Highland Creek and the East Fork	Constitution Mine Complex and Tailings Douglas Mine Tailings Pile
PC307 to PC308	The confluence of Highland Creek and the East Fork to the confluence of Denver Creek with the East Fork	Denver Mine Adit Pittsburgh Mine Hilarity Mine
PC308 to PC305	The confluence of Denver Creek with the East Fork to the confluence of Pine Creek with the South Fork Coeur d'Alene River	Nabob Mine Complex Denver Creek Tailings Pile Liberal King Tailings Pile and Millsite Amy-Matchless Mine and Millsite Coeur d'Alene Antimony Mine

6.0 REFERENCES

Section 1—Introduction

Bureau of Land Management (BLM). 1999. Source Area ARCINFO GIS Coverage, Coeur d'Alene Field Office, Coeur d'Alene, Idaho. Received by URS, July 1999.

———. 1998. Final Draft Engineering Evaluation/Cost Analysis Report, Pine Creek Mill sites. Prepared by the U.S. Bureau of Land Management Coeur d'Alene Office, Inc. March 6.

CH2MHILL. 1998. Memorandum from CH2MHILL Bunker Hill Field Office to USEPA concerning removals at Nevada Stewart Mine.

Fortier. 2000. Personal Communication with John Lincoln, CH2MHill. RE: BLM Cleanup Actions in the Coeur d'Alene Basin. As cited in Draft Coeur d'Alene Basin Ecological Feasibility Study, September 28, 2000.

Stevenson. 1998. Presentation on U.S. Bureau of Land Management Pine Creek Floodplain Restoration work made at the June 10, 1998 Coeur d'Alene Basin Interagency Group Meeting.

USEPA. 1996. Action Memorandum for Removal Action in the Douglas Mine Site, Shoshone County, Idaho. July 25.

———. 1988. Guidance Document for Conducting Remedial Investigations and Feasibility Studies under CERCLA, Interim Final. OSWER Directive 9355.3-01. Office of Emergency and Remedial Response. Washington, D.C. October 1988.

Section 2.1—Geology and Mines

Box, Stephen E., Arthur A. Bookstrom, and William N. Kelley. 1999. *Surficial Geology of the Valley of the South Fork of the Coeur d'Alene River, Idaho.* Open-File Report OF 99-xxx. Draft Version. U.S. Department of the Interior, U.S. Geological Survey, Spokane, Washington. October 4, 1999.

Bureau of Land Management (BLM). 1999. Source Area ARCINFO GIS Coverage, Coeur d'Alene Field Office, Coeur d'Alene, Idaho. Received by URS, July 1999.

Camp Dresser & McKee Inc. 1986. *Interim Site Characterization Report for the Bunker Hill Site*. Prepared for U. S. Environmental Protection Agency under EPA Contract No. 68-01-6939, Work Assignment No. 59-0L20. August 4, 1986.

C.C. Johnson & Malhotra (CCJM). 1995. *Draft Pine Creek Preliminary Assessment/Remedial Investigation*. Performed by C.C. Johnson & Malhotra, Lakewood, CO for the U.S. Department of the Interior, Forest Service, Wallace Ranger District, Silverton, ID. Prepared by Idaho Geological Survey. January.

Forrester, J.D., and Nelson, V.E. 1944. *Lead and Zinc Deposits of the Pine Creek Area, Coeur d'Alene Mining Region, Shoshone County, Idaho.* Open-File Report 45-5. U.S. Geological Survey.

Gott, Garland B. and J.B. Cathrall. 1980. *Geochemical-Exploration Studies in the Coeur d'Alene District, Idaho and Montana.* Geological Survey Professional Paper 1116. U.S. Department of the Interior. U.S. Government Printing Office, Washington, D.C.

McCulley, Frick & Gilman, Inc. (MFG). 1992. *Bunker Hill Superfund Site Remedial Investigation Report.* Vol. 1. Prepared by MFG, Boulder, Colorado, for Gulf Resources and Chemical Corporation/Pintlar Corporation. May 1, 1992.

Mitchell, Victoria E. 1996. *History of Selected Mines in the Pine Creek Area, Shoshone County, Idaho.* Idaho Geological Survey, University of Idaho, Moscow, Idaho. July 1996.

Mitchell, Victoria E., and Earl H. Bennett. 1983. *Production Statistics for the Coeur d'Alene Mining District, Shoshone County, Idaho—1884-1980.* Technical Report 83-3. Idaho Geological Survey, University of Idaho, Moscow, Idaho. May 1983.

Quivik, Fredric L. 1999. *Expert Report of Fredric L. Quivik, Ph.D.* United States District Court, District of Northern Idaho. *United States v. ASARCO, et al.* Civil Action No. 96-0122-N-EJL. August 28, 1999.

Ransome, Frederick Leslie, and Frank Cathcart Calkins. 1908. *The Geology and Ore Deposits of the Coeur d'Alene District, Idaho.* Professional Paper 62. U.S. Geological Survey, Department of the Interior. U.S. Government Printing Office, Washington, D.C.

Ridolfi. 1999. *Restoration Alternatives Plan for the Coeur d'Alene Basin Natural Resource Damage Assessment.* Prepared for the Coeur d'Alene Tribe by Ridolfi Engineers and Associates, Inc., Seattle, Washington. September 1.

SAIC. 1993. Draft Mine Sites Fact Sheets for the Coeur d'Alene River Basin. Prepared by SAIC, Bothell, Washington, for U.S. EPA Region 10. December 1993.

Stratus Consulting, Inc. (Stratus). 1999. *Report of Injury Assessment: Coeur d'Alene Basin Natural Resource Damage Assessment.* Draft Confidential Consultant/Attorney Work Product. Prepared by Stratus Consulting, Inc., Boulder, Colorado, for U.S. Fish and Wildlife Service; U.S. Department of Agriculture, Forest Service; and Coeur d'Alene Tribe. Draft, July 19, 1999.

Toth, J. 1963. "A Theoretical Analysis for Groundwater Flow in Small Drainage Basins. "*Journal of Geophysical Research.* Vol. 68, No. 16. Pp. 4795-4812.

Umpleby, Joseph B., and E.L. Jones, Jr. 1923. *Geology and Ore Deposits of Shoshone County, Idaho.* Bulletin 732. U.S. Geological Survey, U.S. Department of the Interior. U.S. Government Printing Office, Washington, D.C.

Section 2.2—Hydrogeology

C.C. Johnson & Malhotra (CCJM). 1995. *Draft Pine Creek Preliminary Assessment/Remedial Investigation*. Performed by C.C. Johnson & Malhorta, Lakewood, CO, for the U.S. Department of the Interior, Bureau of Land Management.

Coeur d'Alene River Basin Commission (CdRBC). 1997. *Draft Water Quality Assessment - South Fork Coeur d'Alene River*. USGS Hydrologic Unit 17010302. December 5.

Freeze, R. Allan, and John A. Cherry. 1979. *Groundwater*. Prentice-Hall, Inc., Englewood Cliffs, New Jersey.

McCulley, Frick, & Gilman, Inc (MFG). 1992. *Bunker Hill Superfund Site Remedial Investigation Report*. Vol. 1. Prepared by MFG, Boulder, Colorado, for Gulf Resources and Chemical Corporation/Pintlar Corporation. May 1992.

Ridolfi 1999. *Restoration Alternatives Plan For The Coeur d'Alene Basin Natural Resource Damage Assessment*. Prepared for the Coeur d'Alene Tribe by Ridolfi Engineers and Associates, Inc., Seattle, Washington. September 1.

Toth, J. 1963. "*A Theoretical Analysis for Groundwater Flow in Small Drainage Basins.*" *Journal of Geophysical Research.* Vol. 68, No. 16, pages 4795-4812.

Section 2.3—Surface Water Hydrology

Federal Insurance Administration (FIA). 1979. Flood Insurance Study, Shoshone County, ID, March 1979.

U.S. Geological Survey (USGS). 2000. Mean Daily Discharge Data: Available, World Wide Web, URL: http://waterdata.usgs.gov/nwis-w/ID/.

Western Regional Climate Center (WRCC). 2000. Climate Summary for Stations in Idaho: Available, World Wide Web, URL: http://www.wrcc.dri.edu/summary/climsmid.html

Section 3—Sediment Transport

Dunne, T., and L.B. Leopold. 1978. Water in Environmental Planning. New York, W.H. Freeman and Co., 818 p.

Federal Insurance Administration (FIA). 1979. Flood Insurance Study, Shoshone County, ID, March 1979.

Idaho Department of Environmental Quality (IDEQ). 1999. Beneficial Use Reconnaissance Project. Raw data sheets provided by Geoff Harvey, Idaho Department of Fish and Game, April 1999.

———. 1998. Beneficial Use Reconnaissance Project – 1998 Wadeable Streams Workplan. Prepared for the Idaho Division of Environmental Quality by the Beneficial Use Reconnaissance Project Technical Advisory Committee, May 1998.

Leopold, L.B., M.G. Wolman, and J.P. Miller. 1992. Fluvial Processes in Geomorphology. New York, Dover Publications, Inc., 522 p.

Rosgen, D., and H.L. Silvey (ill.). 1996. Applied River Morphology. Pagosa Springs, CO, Wildland Hydrology.

URS Greiner, Inc. and CH2M HILL (URSG and CH2M HILL). 1999. Aerial Photograph Image Library for the Bunker Hill Basin-Wide RI/FS, Version 1.0 [CD-Rom], prepared for U.S. Environmental Protection Agency, Region 10, dated March 22, 1999, 1 disk.

U.S. Army Corps of Engineers (USACE). 1989. Sedimentation Investigations of Rivers and Reservoirs: EM 1110-2-4000; Washington, D.C., USACE.

U.S. Department of Agriculture (USDA). 1991. Aerial Photographs, Dated August 24, 1991.

U.S. Geological Survey (USGS). 2000a. Provisional Suspended and Bed Load Sediment Transport Data: Provided by Paul Woods, USGS 2000.

———. 2000b. Mean Daily Discharge Data: Available, World Wide Web, URL: http://waterdata.usgs.gov/nwis-w/ID/.

———. 2000c. Provisional Report, Sediment Transport in the Coeur d'Alene River Basin of Northern Idaho.

Section 4—Nature and Extent of Contamination

Bureau of Land Management (BLM). 1999. Source Area ARCINFO GIS Coverage. Coeur d'Alene Field Office, Coeur d'Alene, Idaho. Received by URS Corporation, Inc., July 1999.

Gearheart R.A., C.A. Ridolfi, D.E. Miller, V. Claassen, and W. Trush. 1999. Restoration Alternatives Plan for the Coeur d'Alene Basin Natural Resource Damage Assessment. Prepared for the Natural Resource Trustees: Coeur d'Alene Tribe, U.S. Department of Agriculture, and U.S. Department of the Interior. September.

Section 5—Fate and Transport

Bureau of Land Management (BLM). 1998. *Information Sheet No. 3 Pine Creek Mill Sites*. Executive Summary of the Final Engineering Evaluation/Cost Analysis Report. Shoshone County, Idaho. August 1998.

Dunne, T., and L.B. Leopold, 1978. Water in Environmental Planning. New York, W.H. Freeman and Co., 818 p.

Leopold, L.B., M.G. Wolman, and J.P. Miller. 1992. Fluvial Processes in Geomorphology; New York, Dover Publications, Inc., 522 p.

U.S. Environmental Protection Agency (USEPA). 2000. Total Maximum Daily Load for Dissolved Cadmium, Dissolved Lead, and Dissolved Zinc in Surface Waters of the Coeur d'Alene Basin. Final Technical Support Document. USEPA Region 10. August 2000.

Woods, P.F. 2000. Personal communication. Re: Underestimation of total lead surface water concentrations. September 2000.

ATTACHMENT 1
Data Source References

Data Source References

Data Source References[a]	Data Source Name	Data Source Description	Reference
2	URS FSPA Nos. 1, 2, and 3	Fall 1997: Low Flow and Sediment Sampling	URS Greiner Inc. 1997. Field Sampling Plan Addendum 1 Sediment Coring in the Lower Coeur d'Alene River Basin, Including Lateral Lakes and River Floodplains
			URS Greiner Inc. 1997. Field Sampling Plan Addendum 2 Adit Drainage, Seep and Creek Surface Water Sampling
			URS Greiner Inc. 1997. Field Sampling Plan Addendum 3 Sediment Sampling Survey in the South Fork of the Coeur d'Alene River, Canyon Creek, and Nine-Mile Creek
3	URS FSPA No. 4	Spring 1998: High Flow Sampling	URS Greiner Inc. 1998. Field Sampling Plan Addendum 4 Adit Drainage, Seep and Creek Surface Water Sampling; Spring 1998 High Flow Event
4	MFG Historical Data Spring 1991	Spring 1991: High Flow Sampling	McCulley, Frick & Gillman, Inc. 1991. Upstream Surface Water Sampling Program Spring 1991 High Flow Event, South Fork Coeur d'Alene River Basin above Bunker Hill Superfund Site: Tables 1 and 2
5	MFG Historical Data Fall 1991	Fall 1991: Low Flow Sampling	McCulley, Frick & Gillman, Inc. 1992. Upstream Surface Water Sampling Program Fall 1991 Low Flow Event, South Fork Coeur d'Alene River Basin above Bunker Hill Superfund Site: Tables 1 and 2
6	EPA/Box Historical Data	Superfund Site Groundwater and Surface Water Data	CH2MHill. 1997. Location of Wells and Surface Water Sites, Bunker Hill Superfund Site. Fax Transmission of Map August 11, 1998
			Environmental Protection Agency. 1998. E-mail from Ben Cope July 15, 1998. Subject: 2 Datasets File Attached: BOXDATA.WK4
7	IDEQ Historical Data	IDEQ Water Quality Data	Idaho Department of Environmental Quality. 1998. Assortment of files from Glen Pettit for water years 1993 through 1996
			Idaho Department of Environmental Quality. 1998. E-mail from Glen Pettit October 6, 1998 Subject: DEQ Water Quality Data Files Attached: 1998 trend Samples.xls, 1997 trend Samples.xls

Data Source References (Continued)

Data Source References[a]	Data Source Name	Data Source Description	Reference
8	EPA/NPDES Historical Data	Water Quality based on NPDES Program	Environmental Protection Agency. 1998. E-mail from Ben Cope August 11, 1998/September 2, 1998. Subject: Better PCS Data Files/Smelterville. Attached: PCS2.WK4, PCSREQ.698/TMT-PLAN.XLS
			Environmental Protection Agency. 1998. E-mail from Ben Cope August 5, 1998. Subject: State of Idaho Lat/Longs File Attached: PAT.DBF
			Environmental Protection Agency. 1998. E-mail from Ben Cope July 15, 1998. Subject: 2 Datasets File Attached: PCSDATA.WK4
10	URS FSPA No. 5	Common Use Areas Sampling	URS Greiner Inc. 1998. Field Sampling Plan Addendum 5 Common Use Areas: Upland Common Use Areas and Lower Basin Recreational Beaches; Sediment/Soil, Surface Water, and Drinking Water Supply Characterization
11	URS FSPA No. 8	Source Area Sampling	URS Greiner Inc. 1998. Field Sampling Plan Addendum 8 Tier 2 Source Area Characterization Field Sampling Plan
12	Historical Groundwater Data from MFG	1997 Annual Groundwater Data Report Woodland Park	McCulley, Frick & Gillman. 1998. 1997 Annual Groundwater Data Report Woodland Park
13	Historical Data from US Forest Service, Idaho Geological Survey and others	Historical Data on Inactive Mine Sites USFS, IGS and CCJM, 1994-1997, Prichard Creek, Pine Creek and Summit Mining District	Mackey K, Yarbrough, S.L. 1995. Draft Removal Preliminary Assessment Report Pine Creek Millsites, Coeur d'Alene District, Idaho, Contract No. 1422-N651-C4-3049
			Idaho Geological Survey. 1999. Site Inspection Report for the Abandoned and Inactive Mines in Idaho on U.S. Forest Service Lands (Region 1), Idaho Panhandle National Forest Vol. I, Prichard Creek and Eagle Creek Drainages
			Idaho Geological Survey. 1999. Site Inspection Report for the Abandoned and Inactive Mines in Idaho on U.S. Forest Service Lands (Region 1), Idaho Panhandle National Forest Vol. III, Coeur d'Alene River Drainage Surrounding the Coeur d'Alene Mining District (Excluding the Prichard Creek and Eagle Creek Drainages)
			Idaho Geological Survey. 1999. Site Inspection Report for the Abandoned and Inactive Mines in Idaho on U.S. Forest Service Lands (Region 1), Idaho Panhandle National Forest Vol. IV, Prichard Creek and Eagle Creek Drainages

Data Source References (Continued)

Data Source References[a]	Data Source Name	Data Source Description	Reference
13	Historical Data from US Forest Service, Idaho Geological Survey and others (continued)		Idaho Geological Survey. 1999. Site Inspection Report for the Abandoned and Inactive Mines in Idaho on U.S. Forest Service Lands (Region 1), Idaho Panhandle National Forest Vol. V, Coeur d'Alene River Drainage Surrounding the Coeur d'Alene Mining District (Excluding the Prichard Creek and Eagle Creek Drainages) Part 2 Secondary Properties
			US Forest Service. 1995. Pilot Inventory of Inactive and Abandoned Mine Lands, East Fork Pine Creek Watershed, Shoshone County, Idaho
14	Historical Sediment Core Data: University of Idaho (Thesis papers)	Historical Lateral Lakes Sediment Data from F. Rabbi and M.L. Hoffman	Characterization of Heavy Metal Contamination in Two Lateral Lakes of the Lower Coeur d'Alene River Valley, A thesis by M.L. Hoffmann, May 1995
			Trace Element Geochemistry of Bottom Sediments and Waters from the Lateral Lakes of Coeur d'Alene River, A Dissertation by F. Rabbi, May 1994
15	URS FSPA No. 9	Source Area Characterization; Field XRF Data	CH2M Hill and URS Greiner. 1998. Field Sampling Plan Addendum 9 Delineation of Contaminant Source Areas in the Coeur d'Alene Basin using Survey and Hyperspectral Imaging Techniques
16	Historical Sediment Data	Electronic Data compiled by USGS	U.S. Geological Survey. 1992. Effect of Mining-Related Activities on the Sediment-Trace Element Geochemistry of Lake Coeue d'Alene, Idaho, USA--Part 1: Surface Sediments, USGS Open-File Report 92-109, Prepared by A.J. Horowitz, K.A. Elrick, and R.B. Cook
			US Geological Survey. 2000. Chemical Analyses of Metal-Enriched Sediments, Coeur d'Alene Drainage Basin, Idaho: Sampling, Analytical Methods, and Results. Draft. October 13, 2000. Prepared by S.E. Box, A.A. Bookstrom, M. Ikramuddin, and J. Lindsey. Samples collected from 1993 to 1998.
17	USGS Spokane River Basin Sediment Samples	Surface Sediment Samples Collected by USGS in the Spokane River Basin	Environmental Protection Agency. 1999. Data Validation Memorandum and Attached Table from Laura Castrilli to Mary Jane Nearman dated June 9, 1999. Subject: Coeur d'Alene (Bunker Hill) Spokane River Basin Surface Sample Samples, USGS Metals Analysis, <63 um fraction, Data Validation, Samples SRH7-SRH30

Data Source References (Continued)

Data Source References[a]	Data Source Name	Data Source Description	Reference
18	USGS Snomelt Surface Water Data	Surface Water Data from 1999 Snomelt Runoff Hydrograph	USGS. 1999. USGS WY99.xls Spreadsheet dowloaded from USGS (Coeur d'Alene Office) ftp site
			USGS. 2000. Concentrations and Loads of Cadmium, Lead and Zinc Measured near the Peak of the 1999 Snomelt Runoff Hydrograph at 42 Stations, Coeur d'Alene River Basin Idaho
			USGS. 2000. Concentrations and Loads of Cadmium, Lead and Zinc Measured on the Ascending and Descending Limbs of the 1999 Snomelt Runoff Hydrograph at Nine Stations, Coeur d'Alene River Basin Idaho
22	MFG Report on Union Pacific Railroad Right-of-Way Soil Sampling	Surface and Subsurface Soil Lead Data	MFG. 1997. Union Pacific Railroad Wallace Branch, Rails to Trails Conversion, Right-of-Way Soil Sampling, Summary and Interpretation of Data. McCulley, Frick and Gilman, Inc. March 14, 1997
23	URS FSPA No. 11A	Source Area Groundwater and Surface Water Sampling	URS Greiner Inc. 1999. Field Sampling Plan Addendum 11A Tier 2 Source Area Characterization
24	URS FSPA No. 15	Common Use Area Sampling—Spokane River	URS Greiner Inc. 1999. Field Sampling Plan Addendum 15 Spokane River - Washington State Common Use Area Sediment Characterization
25	URS FSPA No. 18	Depositional and Common Use Area Sediment Sampling - Spokane River	URS Greiner Inc. 2001. Final Field Sampling Plan Addendum No. 18, Fall 2000 Field Screening of Sediment in Spokane River Depositional Areas, Summary of Results. Revision 1. January 2001.

Data Source References (Continued)

Data Source References[a]	Data Source Name	Data Source Description	Reference
28	USGS National Water Quality Assessment database	Surface water data for sampling location NF50 at Enaville, Idaho	USGS. 2001. USGS National Water Quality Assessment database: http://infotrek.er.usgs.gov/pls/nawqa/nawqa.wwv_main.gohome. Data retrieved on August 2, 2001 for station 12413000, NF Coeur d'Alene River At Enaville, Idaho.

[a]Reference Number is the sequential number used as cross reference to associate chemical results in data summary tables with specific data collection efforts.

ATTACHMENT 2
Data Summary Tables

ABBREVIATIONS USED IN DATA SUMMARY TABLE

LOCATION TYPES:

AD adit
BH borehole
FP flood plain
GS ground surface/near surface
HA hand auger boring
LK lake/pond/open reservoir
OF outfall/discharge
RV river/stream
SP stockpile
TL tailings pile

QUALIFIERS:

U Analyte was not detected above the reported detection limit
J Estimated concentration

DATA SOURCE REFERENCES:

Data source references listed in Attachment 1 are shown in the data summary tables in the "Ref" column.

Data Summary Table
Pine Creek - segment PineCrkSeg01

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Soil (mg/kg)														
PC7554	TL	13	07/25/1994	0	437	523	82.6	1430	19900	7690	846	0.53	56.1	4410
PC7560	TL	13	07/22/1994	0	10	152	0.09 U	105	45300	4710	37.4	2.8	9.9	1010
PC7583	TL	13	07/22/1994	0	17.2	139	30.7	67.1	22100	4930	1080	0.57	9.5	8990
PC7638	GS	13	07/18/1994	0	8.7	30.9	0.73	64.3	32700	1710	1060	0.58	2	894
PC7639	GS	13	07/18/1994	0	9.6	26.6	1.3	79.7	25100	2790	1020	0.43	4.6	535
PC7640	GS	13	07/19/1994	0	2.9	62.5	1.1	39.2	24300	963	929	0.4	1.7	633
PC7641	GS	13	07/19/1994	0	0.23 U	15.7	0.96	13.4	27500	183	1940	0.12	0.17	254
Subsurface Soil (mg/kg)														
PC7554	TL	13	07/25/1994	10	23.9	173	8.5	33.3	128000	6960	8990	4.4	10.4	1370
PC7560	TL	13	07/22/1994	0.8	12.1	181	34.7	197	63400	4170	1550	4.3	8.5	16800
PC7560	TL	13	07/22/1994	2.6	8	29.8	0.09 U	0.06 U	34000	847	207	2.5	0.76	408
PC7583	TL	13	07/22/1994	0.75	3.1	20.1	9.5	22.6	20600	1990	1070	2.7	3.2	3460
PC7583	TL	13	07/22/1994	1.5	10.1	18.3	10.4	55.2	20000	1300	222	1	4.8	3780
Sediment (mg/kg)														
PC7610	RV	13	07/15/1994	0	18.04 U	48.3	10.1	126	22400	802	1290	0.15 U	1.6	1160
PC7611	SP	13	07/15/1994	0	13.76 U	26.7	5.7	38.4	45800	241	492	0.11 U	0.92 U	1780
PC7612	RV	13	07/15/1994	0	12.96 U	7.4	1.4	17.9	13200	278	594	0.11 U	0.86 U	596
PC7613	RV	13	07/15/1994	0	17.39 U	14.1	0.98 U	42.4	19400	1190	564	0.18	1.16 U	926
PC7614	SP	13	07/15/1994	0	25.75 U	242	1.46 U	47.1	26100	1410	193	0.38	1.72 U	770
PC7615	WL	13	07/15/1994	0	28.78 U	83.5	15.5	125	35100	3260	411	0.84	4.1	2610
PC7616	WL	13	07/15/1994	0	28.37 U	106	1.61 U	48.3	7960	776	16.1	0.24 U	2.3	807
PC7617	RV	13	07/15/1994	0	14.72 U	15.6	0.83 U	21.8	18800	450	608	0.12 U	0.98 U	1040
PC7618	RV	13	07/15/1994	0	18.9 U	21.8	0.96 U	30.4	20500	808	731	0.18	1.13 U	1140
PC7619	RV	13	07/15/1994	0	14.92 U	18.5	2.6	31.6	13900	426	566	0.13	0.99 U	829
PC7620	RV	13	07/15/1994	0	14.85 U	89.6	11	32.4	39300	1320	1210	0.12 U	1	1960
PC7621	RV	13	07/15/1994	0	35.61 U	81.6	14.4	284	24100	1940	1270	0.3 U	3.5	3580
PC7622	RV	13	07/15/1994	0	46.15 U	15.9	2.61 U	63.7	32800	192	1190	0.38 U	3.07 U	388
PC7623	SP	13	07/16/1994	0	14.7	42.1	18.2	117	22900	* 5510	1080	1.2	12.2	6930
PC7624	RV	13	07/16/1994	0	11.7	80.4	6.6	55.5	23200	4240	1280	0.66	7.9	2960
PC7625	RV	13	07/16/1994	0	10.8	59.4	10.8	51.9	21800	4310	1400	0.99	7.4	4080
PC7627	SP	13	07/16/1994	0	46.33 U	262	13.7	118	21100	2240	1130	0.39 U	3.1	3790
PC7628	SP	13	07/16/1994	0	17.22 U	192	10.3	164	16700	2670	1340	0.39	2.8	3500
PC7629	SP	13	07/16/1994	0	28.6 U	206	10.2	83	28800	* 6680	110	0.94	2	2970
PC7630	RV	13	07/16/1994	0	3.9	236	0.56	67.4	39000	1160	440	1.6	1	1000

Data Summary Table
Pine Creek - segment PineCrkSeg01

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Sediment (mg/kg)														
PC7631	RV	13	07/16/1994	0	1.45 U	2.3 U	0.48 U	31.4	19600	72.4	619	0.61 U	0.61 U	161
PC821	TP	2	12/12/1997	0	0.99 J	38.6 J	3.71 J	42.3 J	28000 J	520 J	629 J	0.0836 J	1.51 J	875 J
PC821	TP	2	12/12/1997	1.5	0.938 J	9.5 J	1.99	20.3	17000	612	549 J	0.0487 U	1.36 J	558
PC823	TP	2	12/12/1997	0	0.931 J	12.1 J	2.4 J	50.2	23600	279	378 J	0.0488 U	1.23 J	658
PC824	TP	2	12/12/1997	0.5	1 J	8.32 J	1.71	36.4	20200	514	553 J	0.0515 U	1.42 J	497
PC824	TP	2	12/12/1997	3	0.975 J	16.8 J	1.84	26.7	17800	447	319 J	0.0536 J	1.1 J	478
PC826	TP	2	12/12/1997	0	1.03 J									
PC826	TP	2	12/12/1997	0		56.5 J	2.75	39.4	21800	920	953 J	0.206	2.27	704
PC826	TP	2	12/12/1997	1	2.57 UJ	63.6 J	1.84 J	43	23400	707	435 J	0.223	3.54	562
PC829	TP	2	12/12/1997	0	0.973 J	13.2 J	1.96 J	21.2	21600	334	346 J	0.0509 U	1.1 J	520
PC830	TP	2	12/12/1997	0	0.908 J	15.3 J	5.88	25	20300	390	547 J	0.0752 J	1.68 J	1280
PC830	TP	2	12/12/1997	1	1.04 J	32.4 J	6.97	33	22300	396	859 J	0.0546 U	1.52 J	639
PC832	TP	2	12/12/1997	0	1.01 J	18.5 J	2.01	24.6	17600	551	502 J	0.0772 J	1.47 J	680
PC832	TP	2	12/12/1997	1	0.983 J	7.84 J	1.78	23.1	16000	412	450 J	0.1	1.19 J	606
PC834	TP	2	12/13/1997	0	1.01 J	16.5 J	2.33	28.4	19100	446	408 J	0.0524 U	1.15 J	801
PC835	TP	2	12/13/1997	0.5	0.919 J	19 J	1.82 J	22.7	20100	357	392 J	0.0792 J	1.1 J	637
PC835	TP	2	12/13/1997	2.5	1.02 J	14.7 J	1.72	29.2	20700	449	462 J	0.0533 U	1.5 J	609
PC837	TP	2	12/13/1997	0	0.996 J	12.7 J	2.83	38.2			644 J			1030
PC837	TP	2	12/13/1997	0					16300	746		0.149	2.23	
PC837	TP	2	12/13/1997	2.5	3.01 UJ	36.8 J	5.79 J	137 J	50900 J	880	771	0.121	3.11	1240 J
PC840	TP	2	12/13/1997	0	1.01 J	13.2 J	4.4 J	27.5 J	17700 J	690	959	0.0756 J	1.43 J	1020 J
PC840	TP	2	12/13/1997	2.5	0.997 J	10.1 J	2.03 J	16.8 J	14800 J	636	440	0.0522 U	1.3 J	693 J
PC842	TP	2	12/13/1997	0	0.987 J	5.46 J	3.11 J	9.84 J	9890 J	384	254	0.0536 U	1.4 J	1090 J
PC843	TP	2	12/13/1997	0.5	9.21 UJ	6.33 J	2.37 J	30.3 J	11100 J	646	552	0.0941 J	26.6	728 J
PC843	TP	2	12/13/1997	2.5	0.923 J	5.33 J	1.42 J	11.3 J	8480 J	564	437	0.0521 J	0.719 J	587 J
PC845	TP	2	12/13/1997	0	0.897 J	4.95 J	1.33 J		14600 J	204	233	0.0497 U	0.824 J	319 J
PC846	TP	2	12/13/1997	0.5	1.05 J	21.3 J	7.21 J	25.5 J	15300 J	608	999	0.121	1.65 J	1720 J
PC846	TP	2	12/13/1997	2.5	1.05 J	17.1 J	2.85 J	13.7 J	9470 J	198	228	0.0608 J	0.822 J	762 J
PC848	TP	2	12/14/1997	0.5	1.02 J	5.39 J		14.6 J		11.1		0.0502 U		30.1 J
PC848	TP	2	12/14/1997	0.5			0.354 J		13500 J		907		0.68 J	
PC848	TP	2	12/14/1997	2.5	1.03 J	5.74 J	0.416 J	12.3 J	14500 J	14.7	679	0.0579 U	0.559 J	30.4 J
PC851	TP	2	12/14/1997	0	0.917 J	1.34 UJ	0.113 J	6.58 J	6270 J	5.16	608	0.0459 U	0.203 J	10 J
PC852	TP	2	12/14/1997	0.5	0.938 J	2.04 UJ	0.19 J	10.1 J	7280 J	6.31	361	0.0541 U	0.175 J	17.4 J
PC852	TP	2	12/14/1997	2.5	1 J	2.65 UJ	0.259 J	14 J	9180 J	10.8	686	0.0562 U	0.366 J	23.1 J
Groundwater - Total Metals (ug/l)														
PC7595	MW	13	07/27/1994		7.2	2 U	97.8	45.2	5 U	1 U	10.8	0.2 U	0.4 U	* 10200

Data Summary Table
Pine Creek - segment PineCrkSeg01

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Groundwater - Total Metals (ug/l)														
PC7596	MW	13	07/27/1994		2.3	2 U	5.2	1.7	5 U	1 U	22.7	0.2 U	0.4 U	1950
PC7597	MW	13	07/27/1994		6.2	2 U	0.3 U	3.4	41.9	1 U	25.1	0.2 U	0.4 U	103
PC7598	MW	13	07/27/1994		7.7	2 U	1	3.7	47.5	1.2	9.3	0.2 U	0.4 U	322
PC7599	MW	13	07/27/1994		6.3	4	0.3 U	2.7	5 U	1 U	162	0.2 U	0.4 U	224
PC7600	MW	13	07/27/1994		2.1	2 U	10.9	2.3	5 U	2.5	80.2	0.2 U	0.4 U	* 3840
PC7601	MW	13	07/29/1994		3	1 U	11.2	5.5	358	11.3	1390	0.2 U	0.4 U	* 4860
Surface Water - Total Metals (ug/l)														
PC306	RV	2	11/13/1997		0.05 U		0.069 U	0.06 U	5 U		1 U	0.1 U	0.22 U	9.3 U
PC306	RV	2	11/13/1997			0.17				0.13 J				
PC306	RV	18	05/23/1999						20 U	1	2			
PC306	RV	3	05/16/1998		0.2 U	0.2 U		0.4 U	21.5 U	0.1 U	0.4 U	0.2 U		1.1 U
PC307	RV	2	11/13/1997		0.56 U	0.65	3	0.73 J	68.6 J	2.6	1.4 J	0.1 U	0.22 U	1460
PC307	RV	7	10/29/1993				3			7				1270
PC307	RV	7	12/01/1993				2.9			6				1270
PC307	RV	7	12/21/1993				2.8			2.5 U				1210
PC307	RV	7	01/21/1994				2.9			2.5 U				1160
PC307	RV	7	02/17/1994				2.6			2.5 U				1220
PC307	RV	7	03/08/1994				2.1			10				940
PC307	RV	7	03/23/1994				2.4			5 J				955
PC307	RV	7	04/08/1994				2.1			2.5 U				893
PC307	RV	7	04/18/1994				1.9			10				593
PC307	RV	7	05/06/1994				2.3			2.5 U				773
PC307	RV	7	05/20/1994				2.5			2.5 U				813
PC307	RV	7	06/09/1994				2.8			2.5 U				1000
PC307	RV	7	06/24/1994				3.3			2.5 U				1010
PC307	RV	7	07/22/1994				3.2			2.5 U				773
PC307	RV	7	08/18/1994				2.9			2.5 U				980
PC307	RV	7	09/26/1994				3.5			6				1080
PC307	RV	7	10/05/1994				3.1			19				1060
PC307	RV	7	11/16/1994				2.6			5 J				1180
PC307	RV	7	01/10/1995				2.2			10				1040
PC307	RV	7	02/09/1995				2.4			7				876
PC307	RV	7	03/07/1995				2.2			7				978
PC307	RV	7	03/23/1995				2.5			6				778
PC307	RV	7	04/14/1995				3.9			5 J				970
PC307	RV	7	04/25/1995				2.1			2.5 U				828

Data Summary Table
Pine Creek - segment PineCrkSeg01

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Total Metals (ug/l)														
PC307	RV	7	05/10/1995				1.4			2.5 U				582
PC307	RV	7	05/24/1995				2.2			5 J				647
PC307	RV	7	06/12/1995				2			2.5 U				682
PC307	RV	7	06/27/1995				1.9			5 J				680
PC307	RV	7	07/12/1995				2.2			2.5 U				840
PC307	RV	7	07/25/1995				2.6			9				817
PC307	RV	7	08/14/1995				2.8			2.5 U				930
PC307	RV	7	09/13/1995				2.8			5 J				888
PC307	RV	3	05/15/1998		0.5 U	1 U	1.8	3 U	20 U	2	5 U	0.2 U	0.3 U	696
PC308	RV	2	11/13/1997		0.37 U	0.19	17	1 J	21 U	13.2	1 U	0.1 U	0.22 U	* 7150
PC308	RV	7	10/29/1993				13.3			9				* 5770
PC308	RV	7	12/01/1993				13.2			7				* 5280
PC308	RV	7	12/21/1993				16.1			19				* 6370
PC308	RV	7	01/21/1994				10			5 J				* 5370
PC308	RV	7	02/17/1994				9.8			6				* 4600
PC308	RV	7	03/08/1994				10			6				* 3900
PC308	RV	7	03/23/1994				8.3			12				* 3190
PC308	RV	7	04/08/1994				6.9			5 J				3000
PC308	RV	7	04/18/1994				9			2.5 U				2860
PC308	RV	7	05/03/1994				9.8			6				* 3140
PC308	RV	7	05/19/1994				11			5 J				* 3580
PC308	RV	7	06/09/1994				13			7				* 4000
PC308	RV	7	06/24/1994				14			6				* 4460
PC308	RV	7	07/22/1994				15			17				* 4430
PC308	RV	7	11/16/1994				19			8				* 7260
PC308	RV	7	01/10/1995				11			15				* 4260
PC308	RV	7	02/09/1995				7.7			7				* 3260
PC308	RV	7	03/22/1995				7.2			17				2820
PC308	RV	7	04/14/1995				8.4			9				* 3730
PC308	RV	7	04/25/1995				7.4			7				* 3490
PC308	RV	7	05/10/1995				9			9				* 3680
PC308	RV	7	05/24/1995				10			12				* 3940
PC308	RV	7	06/12/1995				11			14				* 3990
PC308	RV	7	06/27/1995				12			20				* 4260
PC308	RV	7	07/12/1995				11			7				* 4130
PC308	RV	7	07/25/1995				14			10				* 4070
PC308	RV	7	08/14/1995				15			7				* 4720

Data Summary Table
Pine Creek - segment PineCrkSeg01

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Total Metals (ug/l)														
PC308	RV	7	09/13/1995				15			10				* 4830
PC308	RV	3	05/15/1998		0.55	1 U	9.6	3 U	20 U	5.5	5 U	0.2 U	0.3 U	* 3100
PC309	RV	2	11/12/1997		0.94 U	0.16 U	0.069 U	0.22 J	9.6 U	0.33 J	1 U	0.1 U	0.22 U	12.9 U
PC309	RV	3	05/15/1998		0.5 U	1 U	0.1 U	3 U	20 U	0.5 U	5 U	0.2 U	0.3 U	5 U
PC310	RV	2	11/12/1997		3.9 J	8.1 J	5.5	* 191	7130	77.8	704	0.1 U	0.22 J	* 5190
PC312	RV	2	11/11/1997		1.3 U	0.16 U	1.8	0.49 J	6.1 U	0.68	1 U	0.1 U	0.22 U	423
PC312	RV	3	05/14/1998		0.5	2 U	0.7	2 U	20 U	1.1	5 U	0.2 U	0.2 U	179
PC322	RV	3	05/15/1998		0.5 U	1 U	1.2	3 U	20 U			0.2 UJ	0.3 U	
PC322	RV	3	05/15/1998							2.8	10.3			569
PC323	RV	3	05/15/1998		0.5 U	1 U	3	3 U	20 U	5.1	5 U	0.2 UJ	0.3 U	1110
PC324	RV	3	05/17/1998		1.2 U	0.2 U	8.9 J	1.3 J	41.1 J	31.9		0.2 U		
PC325	RV	3	05/17/1998		0.089 U	0.23 U	0.041 U	0.44 U	25.4 J	0.41 J	0.9 J	0.16 U	0.042 U	10.8 J
PC326	RV	3	05/18/1998		0.76	1 U	3	3 U	38.2 U	13.6	5 U	0.2 U	0.3 U	732
PC332	AD	2	11/14/1997		0.66 U	3.3	1.3	6.3	27.1 U	0.83	3.3 J	0.1 U	0.22 UJ	61.5 J
PC332	AD	3	05/10/1998		0.2 U	3.1 J	1 J	4.7 J	234	0.6 U	1.4 J	0.2 U	0.4 U	44.9
PC333	AD	2	11/14/1997		0.27 U	0.7 J	0.069 U	3.8	544	37.1	77.7	0.1 U	0.22 U	21.2 UJ
PC333	AD	3	05/10/1998			0.3 J		1.1 J	175 J	9.1	10 J	0.2 U		6.7 J
PC334	AD	2	11/14/1997		0.18 U	0.69 J	29.2	* 568	969	649	1240	0.1 U	0.22 U	* 10500 J
PC335	AD	2	11/14/1997		0.52 U	1.6 J	0.27 J	0.75 U	3350	1.7	922	0.1 U	0.22 U	* 10800 J
PC335	AD	3	05/10/1998			0.8 J	0.5 J	3.7 J	1250 J	1.6 J	750	0.2 U		* 9120
PC336	AD	2	11/14/1997		0.57 U	3.2	3.4	1.7 J	412	10.7	162	0.1 U	0.22 U	1480 J
PC336	AD	3	05/10/1998		0.1 U	1.9 J	3.3 J	1.5 J	396 J	3 J	215	0.2 U		2190
PC338	RV	3	05/15/1998		0.5 U	1 U	0.36	3 U	20 U	1.3	5 U	0.2 UJ	0.3 U	117
PC340	AD	2	11/15/1997		0.23 U	0.99 J	0.8	2.4 J	277	36.2	11.3	0.1 U	0.22 U	278 J
PC340	AD	3	05/11/1998		0.2 U	2 U	0.5	2 U	48	5.4	5 U	0.2 U	0.2 U	161
PC341	AD	2	11/15/1997			0.24 J	22.8		62.8 U			0.1 U	0.22 U	* 14000 J
PC341	AD	2	11/15/1997		0.15 U			11.6		2.4	803			
PC341	AD	3	05/11/1998		0.2 U	2 U	108	38	527	5.7	2560	0.2 U	0.2 U	* 65400
PC343	AD	2	11/15/1997		0.41 U	0.87 J	7.6	2 J	734	8.5	985	0.1 U	0.22 U	* 11600 J
PC343	AD	3	05/11/1998		0.2 U	2 U	8.2	4	90	0.6	813	0.2 U	0.2 U	* 8100
PC344	AD	2	11/16/1997		241	36.9	0.069 U	0.37 J	142	0.76	15.8	0.1 U	0.22 U	35.6 U
PC348	AD	2	11/16/1997		0.24 U	0.39 J	0.71	0.21 J	10 U	4.1	1.1 J	0.1 U	0.22 U	212
PC348	AD	3	05/10/1998			0.3 J	0.3 UJ	0.4 U	5.6 J	2.7 J	0.4 UJ	0.2 U		75.7
PC348	AD	3	05/10/1998					0.6 J	20.3 J	3.5	0.6 J			102
PC351	AD	2	11/16/1997		1.7 U	0.39 J	0.7	0.56 J	640	6.8	70.9	0.1 U	0.22 U	312
PC352	SP	2	11/16/1997		0.72 U	1.4 J	2.2	1.5 J	143	11.2	8.3 J	0.1 U	0.22 U	2160
PC360	RV	3	05/15/1998		0.5 U	1 U	0.6	3 U	20 U	1.4	5 U	0.2 U	0.3 U	190

Data Summary Table
Pine Creek - segment PineCrkSeg01

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Total Metals (ug/l)														
PC375	SP	3	05/12/1998		0.5 U	1 U	16.5	4.6	47.2	40.7	74.6	0.2 U	0.3 U	* 6210
PC400	AD	3	05/11/1998		0.2 U	3	190	* 149	5520	* 2160	2610	0.2 U	10.7	* 61400
PC7506	RV	13	07/15/1994		1 U	2 U	0.3 U	2.2	176	10.6	0.1 U	0.2 U	0.4 U	333
PC7507	RV	13	07/15/1994		1 U	11.7	7.9	57.9	875	254	78.8	0.2 U	0.4 U	2760
PC7508	RV	13	07/15/1994		1 U	2 U	0.3 U	0.3 U	97.9	1.9	0.1 U	0.2 U	0.4 U	343
PC7509	AD	13	07/15/1994		1 U	2 U	6.7	0.3 U	55.2	15.8	0.1 U	0.2 U	0.4 U	1140
PC7510	AD	13	07/15/1994		1 U	3	5.6	0.3 U	4250	119	178	0.2 U	0.4 U	* 3530
PC7511	SP	13	07/15/1994		1 U	2 U	0.3 U	0.3 U	5 U	2.4	0.1 U	0.2 U	0.4 U	523
PC7512	RV	13	07/15/1994		1 U	6.9	17.6	13.5	23100	157	502	0.2 U	0.4 U	2160
PC7513	RV	13	07/15/1994		1 U	2 U	12	3.3	5 U	8.6	9.6	0.2 U	0.4 U	* 3690
PC7514	RV	13	07/15/1994		1 U	2 U	0.3 U	0.3 U	57.3	1.6	0.1 U	0.2 U	0.4 U	386
PC7515	RV	13	07/15/1994		1 U	2 U	17	0.3 U	5 U	2.3	0.1 U	0.2 U	0.4 U	* 4780
PC7516	RV	13	07/15/1994		1 U	2 U	0.3 U	0.3 U	5 U	2.8	0.1 U	0.2 U	0.4 U	528
PC7517	RV	13	07/15/1994		1 U	2 U	4.4	0.3 U	90.6	3.5	0.1 U	0.2 U	0.4 U	1440
PC7518	RV	13	07/15/1994		1 U	2 U	5.8	0.3 U	5 U	4.4	0.1 U	0.2 U	0.4 U	1500
PC7519	RV	13	07/15/1994		1 U	2 U	0.3 U	0.3 U	5 U	1 U	0.1 U	0.2 U	0.4 U	21.2
PC7520	AD	2	11/15/1997		1.2 U	0.61 J	10	11.9	330	141	45.9	0.1 U	0.22 U	* 5630 J
PC7520	AD	13	07/15/1994		1 U	2 U	19	0.3 U	73.7	22.6	53.1	0.2 U	0.4 U	* 5110
PC7520	AD	3	05/10/1998		1.2 U	1.7 J	167	30.7	590 J	163	732	0.2 U	0.1 U	0.9 U
PC7521	RV	13	07/16/1994		1 U	2 U	0.3 U	0.3 U	180	46.5	11.3	0.2 U	0.4 U	469
PC7522	SP	13	07/16/1994		1 U	2 U	33.5	8.2	5 U	43.8	57.4	0.2 U	0.4 U	* 12000
PC7523	SP	13	07/16/1994		1 U	2 U	40.6	7.4	169	70	6.6	0.2 U	0.4 U	* 13000
PC7524	RV	13	07/16/1994		1 U	2 U	0.3 U	1.5	5 U	1.9	0.1 U	0.2 U	0.4 U	47
PC7525	RV	13	07/16/1994		1 U	2 U	0.3 U	1.4	5 U	1.1	0.1 U	0.2 U	0.4 U	14.3
PC7526	AD	13	07/16/1994		1 U	2 U	2.9	2.1	220	4.2	203	0.2 U	0.4 U	1690
PC7527	RV	13	07/16/1994		1 U	2 U	3.1	0.3 U	5 U	15.9	3.3	0.2 U	0.4 U	606
PC7528	RV	13	07/16/1994		1 U	2 U	0.3 U	2.6	198	44.2	8.8	0.2 U	0.4 U	247
PC7529	RV	13	07/16/1994		1 U	2 U	0.3 U	0.3 U	5 U	1 U	0.1 U	0.2 U	0.4 U	14.6
PC7603	SP	13	07/16/1994		1 U	2 U	3.6	1.7	5 U	3	0.1 U	0.2 U	0.4 U	1300
PC7604	RV	13	07/16/1994		1 U	2 U	0.3 U	3.5	412	92.6	15.5	0.2 U	0.4 U	280
PC7605	RV	13	07/16/1994		1 U	2 U	0.3 U	3.8	186	67.9	1.9	0.2 U	0.4 U	111
Surface Water - Dissolved Metals (ug/l)														
PC306	RV	2	11/13/1997		0.5 U	0.1 U	0.04 U	0.5 U	10 U	0.1 U	1 U	0.2 U	0.03 U	2 U
PC306	RV	18	05/23/1999				1 U		10 U	1 U	1 U			3.9
PC306	RV	3	05/16/1998			0.2 U		0.4 U	15.4 UJ	0.1 U	6.5 J	0.2 UJ		1.9 UJ
PC307	RV	2	11/13/1997		0.53	0.71	3.24	0.54	10 U	1.76	1	0.2 U	0.03 U	1370

Data Summary Table
Pine Creek - segment PineCrkSeg01

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Dissolved Metals (ug/l)														
PC307	RV	7	10/29/1993				3.1			3 J				1280
PC307	RV	7	12/01/1993				2.9			1.5 U				1240
PC307	RV	7	12/21/1993				2.8			5				1230
PC307	RV	7	01/21/1994				3.1			1.5 U				1120
PC307	RV	7	02/17/1994				2.8			1.5 U				1270
PC307	RV	7	03/08/1994				2.2			1.5 U				960
PC307	RV	7	03/23/1994				2.5			1.5 U				966
PC307	RV	7	04/08/1994				2.2			3 J				949
PC307	RV	7	04/18/1994				1.8			1.5 U				578
PC307	RV	7	05/06/1994				2.5			3 J				786
PC307	RV	7	05/20/1994				2.3			1.5 U				824
PC307	RV	7	06/09/1994				3.2			1.5 U				1010
PC307	RV	7	06/24/1994				3.5			4				1040
PC307	RV	7	07/22/1994				3.2			1.5 U				804
PC307	RV	7	08/18/1994				3			2.5 J				1010
PC307	RV	7	09/26/1994				3.3			3 J				1120
PC307	RV	7	10/05/1994				3.2			3 J				1110
PC307	RV	7	11/16/1994				3.1			1.5 U				1240
PC307	RV	7	01/10/1995				2.5			4				1040
PC307	RV	7	02/09/1995				2.1			1.5 U				894
PC307	RV	7	03/07/1995				2.5			4				969
PC307	RV	7	03/23/1995				2.5			4				813
PC307	RV	7	04/14/1995				2.4			1.5 U				948
PC307	RV	7	04/25/1995				2.1			3 J				864
PC307	RV	7	05/10/1995				1.6			1.5 U				577
PC307	RV	7	05/24/1995				2.1			4				652
PC307	RV	7	06/12/1995				1.8			4				687
PC307	RV	7	06/27/1995				1.9			4				690
PC307	RV	7	07/12/1995				2.3			1.5 U				861
PC307	RV	7	07/25/1995				2.6			1.5 U				833
PC307	RV	7	08/14/1995				2.8			3 J				943
PC307	RV	7	09/13/1995				3			3 J				927
PC307	RV	3	05/15/1998		0.5 U	1 U	1.9	3 U	20 U	1.2	5 U	0.2 U	0.3 U	679
PC308	RV	2	11/13/1997		0.5 U	0.18	18.3	1.3	10 U	14.4	1 U	0.2 U	0.03 U	* 7080
PC308	RV	7	10/29/1993				15.2			5				* 5850
PC308	RV	7	12/01/1993				14.5			4				* 5200
PC308	RV	7	12/21/1993				14.2			4				* 6490

Data Summary Table
Pine Creek - segment PineCrkSeg01

Boxed Sample Results Exceed Screening Level By More Than 1X	Shaded Sample Results Exceed Screening Level By More Than 10X	Shaded Results With (*) Exceed Screening Level By More Than 100X

Surface Water - Dissolved Metals (ug/l)

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
PC308	RV	7	01/21/1994				11			4				* 5320
PC308	RV	7	02/17/1994				9.9			3 J				* 4660
PC308	RV	7	03/08/1994				10			6				3910
PC308	RV	7	03/23/1994				8.4			5				3240
PC308	RV	7	04/08/1994				7.3			4				3190
PC308	RV	7	04/18/1994				9.5			4				2970
PC308	RV	7	05/03/1994				10.5			5				3230
PC308	RV	7	05/19/1994				11			4				3670
PC308	RV	7	06/09/1994				12			4				4120
PC308	RV	7	06/24/1994				14			6				* 4560
PC308	RV	7	07/22/1994				15			6				* 4450
PC308	RV	7	11/16/1994				18			5				* 7410
PC308	RV	7	01/10/1995				10			12				* 4320
PC308	RV	7	02/09/1995				8			1.5 U				3270
PC308	RV	7	03/22/1995				7.3			5				2850
PC308	RV	7	04/14/1995				8			7				3680
PC308	RV	7	04/25/1995				7.7			5				3580
PC308	RV	7	05/10/1995				9.6			7				3530
PC308	RV	7	05/24/1995				10			5				4010
PC308	RV	7	06/12/1995				11			8				* 4280
PC308	RV	7	06/27/1995				13			7				* 4220
PC308	RV	7	07/12/1995				12			6				4170
PC308	RV	7	07/25/1995				14			9				4120
PC308	RV	7	08/14/1995				15			6				* 4860
PC308	RV	7	09/13/1995				16			8				* 4980
PC308	RV	3	05/15/1998		0.54	1 U	10	3 U	20 U	4.4	5 U	0.2 U	0.3 U	3000
PC309	RV	2	11/12/1997		0.79	0.1 U	0.04 U	0.5 U	10 U	0.1 U	1 U	0.2 U	0.03 U	4.7
PC309	RV	3	05/15/1998		0.5 U	1 U	0.1 U	3 U	20 U	0.5 U	5 U	0.2 U	0.3 U	5 U
PC310	RV	2	11/12/1997								251	0.2 U		
PC312	RV	2	11/11/1997		1.1	0.25	1.78	0.56	10 U	0.61	1 U	0.2 U	0.03 U	415
PC312	RV	3	05/14/1998		0.5	2 U	0.7	2 U	20 U	0.7	5 U	0.2 U	0.2 U	188
PC322	RV	3	05/15/1998		0.5 U	1 U	1.3	3 U	20 U	1.5		0.2 UJ	0.3 U	
PC322	RV	3	05/15/1998								10.3			561
PC323	RV	3	05/15/1998		0.5 U	1 U	3.1	3 U	20 U	3.2	5 U	0.2 UJ	0.3 U	1090
PC324	RV	3	05/17/1998		1 U	0.2 U	10 J	1.5 J		30.9		0.2 UJ		
PC325	RV	3	05/17/1998		0.15 U	0.23 U	0.041 U	0.44 U	29.1 J	0.44 J	0.92 J	0.16 U	0.042 UJ	9.7 J
PC326	RV	3	05/18/1998		0.6	1 U	3	3 U	20 U	5.7	5 U	0.2 U	0.3 U	728

Data Summary Table
Pine Creek - segment PineCrkSeg01

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Dissolved Metals (ug/l)														
PC332	AD	2	11/14/1997		0.54	3.6	1.37	5.43	10 U	0.41	1.8	0.2 U	0.03 U	57
PC332	AD	3	05/10/1998			2.7 J	0.8 J	3.2 J	171 J	0.8 UJ	0.7 J	0.2 U		39.4
PC333	AD	2	11/14/1997		0.5 U	0.27	0.04 U	0.52	10	0.58	4	0.2 U	0.03 U	4.6
PC333	AD	3	05/10/1998			0.2 U		0.5 J	107 J	1 UJ	0.2 U	0.2 U		5.1 J
PC334	AD	2	11/14/1997		0.5 U	0.29	30.5	* 548	649	* 640	1340	0.2 U	0.03 U	* 11100
PC335	AD	2	11/14/1997		0.5 U	0.49	0.44	0.5 U	15	0.31	930	0.2 U	0.03 U	* 10700
PC335	AD	3	05/10/1998			0.3 J	0.5 UJ	3.3 J	543 J	1.1 U	688	0.2 U		* 8720
PC336	AD	2	11/14/1997		0.5 U	0.91	0.83	0.26	10 U	0.17	143	0.2 U	0.03 U	1250
PC336	AD	3	05/10/1998			0.8 J	0.6 J	0.8 J	215 J	0.1 U	198	0.2 U		2010
PC338	RV	3	05/15/1998		0.5 U	1 U	0.38	3 U	20 U	0.95	5 U	0.2 U	0.3 U	107
PC340	AD	2	11/15/1997		0.5 U	0.31	0.9	0.78	22.4	5.83	7.67	0.2 U	0.03 U	288
PC340	AD	3	05/11/1998		0.2 U	2 U	0.4	2 U	20 U	2.2	5 U	0.2 U	0.2 U	167
PC341	AD	2	11/15/1997		0.5 U	0.33	24.7	10.9	10 U			0.2 U	0.03 U	
PC341	AD	2	11/15/1997							0.98	833			* 13300
PC341	AD	3	05/11/1998		0.2 U	2 U	* 107	15.8	20 U	0.4	* 2530	0.2 U	0.2 U	* 63600
PC343	AD	2	11/15/1997		0.5 U	0.36	7.35	0.5	10 U	0.13	951	0.2 U	0.03 U	* 10100
PC343	AD	3	05/11/1998		0.2 U	2 U	8	3	31	0.2 U	850	0.2 U	0.2 U	* 8310
PC344	AD	2	11/16/1997		267	33.1	0.02 U	0.42	10 U	0.93	8.9	0.2 U	0.03 U	15.2
PC348	AD	2	11/16/1997		0.5 U	0.24	0.88	0.35	10 U	3.89	1.1	0.2 U	0.03 U	214
PC348	AD	3	05/10/1998			0.3 J	0.4 UJ	0.4 U	20.8 J	2.9 J	0.4 U	0.2 U		116
PC351	AD	2	11/16/1997		1.7	0.22	0.6	0.35	357	3.99	71.3	0.2 U	0.03 U	311
PC352	SP	2	11/16/1997		0.65	0.64	2.43	0.83	10 U	1.01	1.4	0.2 U	0.03 U	2050
PC360	RV	3	05/15/1998		0.5 U	1 U	0.64	3 U	20 U	0.7	5 U	0.2 U	0.3 U	185
PC375	SP	3	05/12/1998		0.5 U	1 U	17.3	4.3	20 U	29.6	75	0.2 U	0.3 U	* 6090
PC400	AD	3	05/11/1998		0.2 U	2 U	* 187	135	4220	* 2150	* 2590	0.2 U	0.2 U	* 62300
PC7520	AD	2	11/15/1997		0.61	0.1	10.8	1.6	10 U	19.3	39	0.2 U	0.03 U	* 4850
PC7520	AD	3	05/10/1998		0.4 U	0.6 J	* 135 J	15.3 J	213 J	20 J	588	0.2 U		9.1 U
PC7642	RV	13	—			4 U	0.6 U	0.6 U	59	0.308	0.2 U			10
PC7642	RV	13	03/01/1993			4 U	0.6 U	3.5	115	0.311	0.2 U			5.2
PC7642	RV	13	08/01/1993				0.6 U	3	11	2 U	0.2 U			13
PC7643	RV	13	—			4 U	13	0.6 U	8.8	4	0.2 U			* 6060
PC7643	RV	13	03/01/1993			4 U	14	3.5	76.4	14.8	6.9			* 5540
PC7643	RV	13	08/01/1993			4 U	15.6	3	10 U	4.3	0.2 U			* 5110
PC7644	RV	13	—			4 U	0.6 U	0.6 U	6	0.382	1.2			14
PC7644	RV	13	03/01/1993			4 U	0.6 U	0.6 U	11	0.131	0.2 U			5.7
PC7644	RV	13	08/01/1993			4 U	0.6 U	0.6 U	10 U	2 U	0.2 U			7.4
PC7645	RV	13	—			4 U	0.6 U	0.6 U	24.7	3.65	5.8			364

Data Summary Table
Pine Creek - segment PineCrkSeg01

Boxed Sample Results Exceed Screening Level By More Than 1X	Shaded Sample Results Exceed Screening Level By More Than 10X	Shaded Results With (*) Exceed Screening Level By More Than 100X

Surface Water - Dissolved Metals (ug/l)

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
PC7645	RV	13	03/01/1993			4 U	0.6 U	2.2	15	**1.26**	3.3			**194**
PC7645	RV	13	08/01/1993			4 U	0.6 U	**4.7**	5.8	**2**	3.2			**424**
PC7646	RV	13	---			4 U	0.6 U	0.6 U	2.5	0.984	0.2 U			**1250**
PC7646	RV	13	03/01/1993			4 U	**2.6**	3.1		**3.8**	9.7			**1250**
PC7646	RV	13	08/01/1993			4 U	**3.6**	0.6 U		**1.4**	0.2 U			**1200**
PC7647	RV	13	---			4 U	0.6 U	0.6 U	17	0.08	0.2 U			5.8
PC7647	RV	13	03/01/1993			4 U	0.6 U	0.6 U	14	0.1	0.2 U			8.6
PC7647	RV	13	08/01/1993			4 U	0.6 U	0.6 U	10 U	2 U	0.2 U			11
PC7649	RV	13	---			4 U	0.6 U	0.6 U	13	0.772	0.2 U			**518**
PC7649	RV	13	03/01/1993			4 U	0.6 U	**4.6**	18	**1.58**	1.1			**389**
PC7649	RV	13	08/01/1993			4 U	**2.2**	0.6 U	10 U	2 U	0.2 U			**373**
PC7650	RV	13	---			4 U	0.6 U	0.6 U	14	1.02	1.2			**558**
PC7650	RV	13	03/01/1993			4 U	0.6 U	2.2	22	**1.41**	1.9			**378**
PC7650	RV	13	08/01/1993			4 U	0.6 U	0.6 U	10 U	2 U	0.2 U			**491**
PC7651	RV	13	---			4 U	0.6 U	0.6 U	10 U	**1.44**	1.3			**774**
PC7651	RV	13	03/01/1993			4 U	0.6 U	3.1	16	**3.07**	2.4			**657**
PC7651	RV	13	08/01/1993			4 U	0.6 U	0.6 U	10 U	2 U	0.2 U			**561**
PC7652	RV	13	---			4 U	0.6 U	0.6 U	10 U	**1.12**	0.2 U			**536**
PC7652	RV	13	03/01/1993			4 U	0.6 U	0.6 U	15	**2.38**	1.4			**359**
PC7652	RV	13	08/01/1993			4 U	0.6 U	**7.2**	6	**1.4**	0.2 U			**562**
PC7653	RV	13	---			4 U	0.6 U	0.6 U	10 U	**1.27**	0.2 U			**185**
PC7653	RV	13	03/01/1993			4 U	0.6 U	0.6 U	8.8	**1.55**	0.2 U			**141**
PC7653	RV	13	08/01/1993				0.6 U	**5.7**	10 U	2 U	3.2			**128**
PC7654	RV	13	---			4 U	0.6 U	0.6 U	10 U	**1.67**	0.2 U			**197**
PC7654	RV	13	03/01/1993			4 U	0.6 U	0.6 U	4.6	**1.5**	0.2 U			**199**
PC7654	RV	13	08/01/1993			4 U	0.6 U	0.6 U	4.4	**1.7**	0.2 U			**137**
PC7655	RV	13	---			4 U	0.6 U	0.6 U	10 U	0.12	0.2 U			5.5
PC7655	RV	13	03/01/1993			4 U	0.6 U	0.6 U	2.5	0.094	0.2 U			3.8
PC7655	RV	13	08/01/1993			4 U	0.6 U	0.6 U		2 U	0.2 U			5.1
PC7659	SP	13	06/01/1993			4 U	0.6 U	0.6 U	37.7	2 U	0.2 U			6.5
PC7660	SP	13	06/01/1993			4.52	0.6 U	0.6 U	**11700**	**11.7**	**1060**			**1010**
PC7661	SP	13	06/01/1993			4 U	0.6 U	0.6 U	**1120**	2 U	**467**			0.6 U
PC7662	SP	13	06/01/1993			4 U	0.6 U	0.6 U	48.4	**1.5**	3.8			**777**
PC7663	SP	13	06/01/1993			4 U	0.6 U	0.6 U	479	**1.7**	4.2			8.8
PC7664	SP	13	06/01/1993			4 U	0.6 U	0.6 U	18	2 U	2.5			4.2
PC7665	SP	13	06/01/1993			0.98	**4.1**	0.6 U	81.5	**3.11**	**22**			**3640**
PC7666	SP	13	06/01/1993			4 U	**4.2**	0.6 U	10 U	**1.5**	0.2 U			**2000**

Data Summary Table
Pine Creek - segment PineCrkSeg01

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Dissolved Metals (ug/l)														
PC7667	RV	13	06/01/1993			4 U	32.7	4.2	20.6	39.8	118			* 12900
PC7668	RV	13	06/01/1993			4 U	3.6	19.5	25.6	7.71	7.83			776
PC7669	RV	13	06/01/1993			4 U	11	0.6 U	9.7	23.7	10.3			4070
PC7670	RV	13	06/01/1993			4 U	6.8	0.6 U	11	46.3	2.2			1870
PC7671	RV	13	06/01/1993			4 U	2.4	0.6 U	16	3.11	4.6			1200
PC7672	RV	13	06/01/1993			4 U	0.6 U	0.6 U	6.1	1.8	7.21			539
PC7673	RV	13	06/01/1993			4 U	0.6 U	0.6 U		1.8	6.98			445
PC7674	RV	13	06/01/1993			4 U	0.6 U	0.6 U	10 U	2 U	0.2 U			0.6 U
PC7675	RV	13	06/01/1993			4 U	0.6 U	0.6 U	10 U	2 U	0.2 U			33.8
PC7676	RV	13	06/01/1993			4 U	2.8	0.6 U	20.8	5.42	5.75			1330
PC7677	RV	13	06/01/1993			4 U	9.1	0.6 U			2.1			3260
PC7678	AD	13	08/01/1993			3.1	0.6 U	3.5	10 U	2 U	0.2 U			61
PC7679	AD	13	08/01/1993			4 U	0.6 U	0.6 U	11	1.5	7.86			683
PC7680	AD	13	08/01/1993			4 U	* 46.6	0.6 U	10 U	7.43	62			* 26200
PC7681	AD	13	08/01/1993			2.3	* 226	138	5460	* 2560	* 3070			* 73600
PC7684	AD	13	08/01/1993			4 U	24.3	1.5	7.5	16.9	132			* 8450
PC7685	AD	13	08/01/1993			0.9	1	10	403	1.4	833			* 9950
PC7686	AD	13	08/01/1993			4 U	0.6 U	0.6 U	8.1	2 U	315			2650
PC7687	AD	13	08/01/1993			4 U	0.6 U	0.6 U	3490	2 U	608			12
PC7689	AD	13	08/01/1993			4 U	0.6 U	0.6 U	1160	7.93	147			389
PC7691	AD	13	08/01/1993			4 U	* 61.8	* 1070	1050	* 822	1390			* 16300
PC7693	SP	13	08/01/1993			2.3	0.6 U	0.6 U	10 U	2 U	0.2 U			28.3
PC7694	SP	13	08/01/1993			4 U	2.5	0.6 U	7.6	1.9	216			2070
PC7695	SP	13	08/01/1993			4 U	0.6 U	0.6 U	284	2 U	118			16
PC7696	SP	13	08/01/1993				2.7		4.1		9.05			918
PC7697	SP	13	08/01/1993			4 U	12	4	57.7	7.34	9.61			* 5130

Data Summary Table
Pine Creek - segment PineCrkSeg02

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Surface Water - Total Metals (ug/l)

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
PC311	RV	2	11/12/1997		0.1 U	0.16 U	0.069 U	0.52 J	9.4 U	0.15 J	2.3 J	0.1 U	0.22 U	13.2 U
PC311	RV	18	05/23/1999						40 U					
PC311	RV	3	05/14/1998		0.2 U	2 U	0.2 U	2 U	20	0.2 U	5 U	0.2 U	0.2 U	10 U

Surface Water - Dissolved Metals (ug/l)

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
PC311	RV	2	11/12/1997		0.5 U	0.11	0.04 U	0.5 U	10 U	0.1 U	1 U	0.2 U	0.03 U	2.5
PC311	RV	18	05/23/1999				1 U		10	1 U	1 U			1 U
PC311	RV	3	05/14/1998		0.2 U	2 U	0.2 U	2 U	20 U	0.2 U	5 U	0.2 U	0.2 U	10 U
PC7648	RV	13	---			4 U	0.6 U	0.6 U	17	0.367	0.2 U			12
PC7648	RV	13	03/01/1993			4 U	0.6 U	0.6 U	18	0.18	0.2 U			7.7
PC7648	RV	13	08/01/1993			4 U	0.6 U	**5.2**	10 U	2 U	0.2 U			11

Data Summary Table
Pine Creek - segment PineCrkSeg03

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Surface Soil (mg/kg)

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
PC7531	TL	13	07/21/1994	0	**59.7**	**56.6**	0.09 U	97.2	44300	**7720**	509	0.9	11.3	**660**
PC7539	TL	13	07/21/1994	0	**55.2**	**72.8**	0.08 U	**162**	**71300**	**8260**	472	2.2	10.1	**715**
PC7548	TL	13	07/22/1994	0	6	**347**	0.09 U	57.6	39600	**2880**	93	0.89	5.1	**780**
PC7632	GS	13	07/18/1994	0	5.4	**48.4**	4	55	33400	**825**	818	0.36	1.3	**1030**
PC7633	GS	13	07/18/1994	0	0.24 U	18.4	3	16.5	16600	**422**	697	0.11	0.72	**544**
PC7634	GS	13	07/18/1994	0	0.3 U	14.4	1.9	18.7	17400	**381**	872	0.34	0.45	**395**
PC7635	GS	13	07/18/1994	0	11.1	**220**	0.09 U	45	29700	**4320**	169	2	11.8	**364**
PC7636	GS	13	07/19/1994	0	5.5	**78**	2.9	52.6	23000	**1500**	1070	0.7	2.3	**657**
PC7637	GS	13	07/19/1994	0	0.24 U	9.2	0.08 U	5.8	19600	140	435	0.1 U	0.1 U	64.8

Subsurface Soil (mg/kg)

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
PC7531	TL	13	07/21/1994	0.33	9.4	**98.2**	**122**	**165**	**68900**	**2590**	818	1.7	4	**9530**
PC7531	TL	13	07/21/1994	4	16.8	**39.1**	9	**101**	17400	**973**	913	0.23	0.96	**3100**
PC7539	TL	13	07/21/1994	0.5	20.6	**227**	**49.2**	**311**	**103000**	**4290**	988	4.6	7.7	**16900**
PC7539	TL	13	07/21/1994	2.5	0.3 U	17.6	7	**779**	12100	**1760**	90.1	0.27	1.7	**2510**
PC7548	TL	13	07/22/1994	1.6	4.2	**160**	**43.3**	**580**	13100	**331**	18.6	0.14	0.76	**1460**
PC7548	TL	13	07/22/1994	2.5	0.25 U	**30.5**	0.08 U	24.9	40600	**543**	57.8	0.35	0.27	113

Sediment (mg/kg)

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
PC7606	RV	13	07/14/1994	0	18.49 U	**47.7**	1.1	**41.6**	21200	**738**	321	0.15 U	1.23 U	**270**
PC7608	RV	13	07/15/1994	0	14.17 U	**26.6**	**1.7**	25.5	18900	**304**	569	0.13	0.94 U	**357**
PC7609	RV	13	07/15/1994	0	12.82 U	**25.4**	1.1	17.7	15600	**211**	623	0.11 U	0.85 U	**370**
PC806	TP	2	12/11/1997	0	**29 J**	11.1 J	1.02 J	12.7 J	10100 J	**163 J**	604 J	0.0533 U	0.393 J	187 J
PC806	TP	2	12/11/1997	1	1.29 UJ	8.97 J	0.822 J	17.6 J	20200 J	**91.5 J**	241 J	0.0481 U	0.631 J	**267 J**
PC808	TP	2	12/11/1997	0.5	**31.8 J**	**34.4 J**	0.959 J	31.9 J	24200 J	**249 J**	424 J	0.0562 U	0.937 J	**452 J**
PC808	TP	2	12/11/1997	2.5	11 UJ	**34.6 J**	0.84 J	20.2 J	17700 J	**181 J**	348 J	0.054 U	0.708 J	**303 J**
PC810	TP	2	12/11/1997	0	**19.6 J**	**60.6 J**	0.417 J	13.2 J	14400 J	**83.9 J**	319 J	0.051 U	0.447 J	182 J
PC811	TP	2	12/11/1997	0.5	1.01 J	10.8 J	1.25 J	17.2 J	13600 J	**228 J**	338 J	0.05 U	0.673 J	**393 J**
PC812	TP	2	12/11/1997	0	0.93 J	2.95 J	0.55 J	10.2 J	12300 J	24.8 J	223 J	0.0478 U	0.344 J	**211 J**
PC813	TP	2	12/11/1997	0.5	0.963 J	2.95 J	0.581 J	16.7 J	16000 J	**183 J**	355 J	0.0499 U	0.511 J	**237 J**
PC813	TP	2	12/11/1997	2.5	0.95 J	5.7 J	0.38 J	10.1 J	9620 J	**73.2 J**	127 J	0.0502 U	0.691 J	128 J
PC815	TP	2	12/11/1997	0.5			0.82 J	10.1 J	9170 J	**108 J**	739 J	0.0494 U	0.439 J	
PC815	TP	2	12/11/1997	0.5	0.92 J	2.79 J								**235 J**
PC815	TP	2	12/11/1997	2.5	0.976 J	5.01 J	0.529 J	10.6 J	11300 J	**121 J**	238 J	0.053 U	0.417 J	**216 J**
PC818	TP	2	12/12/1997	1	0.983 J	**19 J**	1.11 J	23.4 J	18000 J	**290 J**	412 J	0.055 U	0.869 J	**357 J**
PC818	TP	2	12/12/1997	4	0.946 J	7.44 J	0.808 J	14.5 J	14300 J	**163 J**	453 J	0.0491 U	0.612 J	**239 J**

Data Summary Table
Pine Creek - segment PineCrkSeg03

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Sediment (mg/kg)														
PC820	TP	2	12/12/1997	0	1.01 J	5.98 J	0.912 J	18.3 J	15600 J	**134 J**	420 J	0.052 U	0.665 J	**320 J**
PC854	HA	2	12/15/1997	0	2.04 U									
PC855	HA	2	12/15/1997	0		**15.5 J**	0.982 J	26.6	13100	**217**	449 J	0.0605 J	0.765 J	**341 J**
PC856	HA	2	12/15/1997	0	1.02 U	**16.6 J**	1.14	22.9	17900	**218**	438 J	0.0582 J	0.993 J	**404 J**
PC857	HA	2	12/15/1997	0	0.949 U	13.4 J	0.809 J	14.6	17100	**143**	316 J	0.0478 J	0.678 J	**262 J**
PC858	HA	2	12/15/1997	0.17	0.98 U	8.34 J	0.738 J	16.4	17600	**111**	271 J	0.0507 J	0.626 J	**310 J**
Groundwater - Total Metals (ug/l)														
PC101	PW	11	12/02/1998		1 U	1 U	1 U	**6.2**	56.5 J	3.2	5 U	0.2 U	5 U	26.2
PC432	MW	23	12/03/1999	58	**7.7**	1 J	0.52 J	5 U	**463**	0.73 J	20.1	0.2 U	5 U	**134**
PC432	MW	23	12/03/1999	17	**7.4**	1 U	0.53 J	5 U	25 U	0.5 U	5 U	0.2 U	5 U	**151**
PC7590	MW	13	07/27/1994		1 U	2 U	0.3 U	*** 134**	**1800**	14.2	**262**	0.2 U	0.4 U	**2370**
PC7591	MW	13	07/18/1994		1 U	2 U	0.3 U	**6.8**	5 U	1 U	5.4	0.2 U	0.4 U	**108**
PC7592	MW	13	07/27/1994		1 U	2 U	0.3 U	*** 166**	**2080**	**16.6**	**244**	0.2 U	0.4 U	**2420**
PC7593	MW	13	07/27/1994		1.6	2 U	1.4	**1.6**	5 U	1 U	2	0.2 U	0.4 U	**98.2**
PC7594	MW	13	07/27/1994		2.5	2 U	0.3 U	**1.2**	5 U	1 U	2.3	0.2 U	0.4 U	**121**
Groundwater - Dissolved Metals (ug/l)														
PC101	PW	11	12/02/1998		1 U	1 U	1 U	5 U	50 U	1 U	5.7 J	0.2 U	5 U	26.5
PC432	MW	23	12/03/1999	58	**7.8**	1 U	0.5 U	5 U	25 U	0.5 U	5 U	0.2 U	5 U	**110**
PC432	MW	23	12/03/1999	17	**7.6**	1 U	**0.53 J**	5 U	25 U	0.5 U	5 U	0.2 U	5 U	**160**
SF138	MW	6	02/17/1998		50 U	5 U	4 U	12 U		3 U		0.2 U		**50**
SF138	MW	6	10/12/1997		50 U	5 U	**6 J**	12 U		3 U		0.2 U		40
SF138	MW	6	10/24/1996		40 U	0.14	3 U			0.1 U		0.2 U		**116**
SF138	MW	6	04/24/1997		45 U	4.5 U	3 U			1.5 U		0.2 U		36.5
SF138	MW	6	02/11/1997		45 U	1.5 U	3 U			1.5 U		0.2		**59.3**
Surface Water - Total Metals (ug/l)														
PC100	RV	11	11/16/1998		0.74 U	0.29 J	1.1	0.41 U	6.9 U	0.82 J	1.5 U	0.2 U	4.5 U	**228**
PC305	RV	6	02/17/1998		50 U	5 U	4 U	12 U		3 U		0.2 U		**230**
PC305	RV	6	10/12/1997		50 U	5 U	4 U	12 U		3 U		0.2 U		**80**
PC305	RV	6	04/24/1997		45 U	4.5 U	3 U	3 U		12.2		0.2 U		**136**
PC305	RV	6	02/04/1997		45 U	4.5 U	3 U	**3.2**		13.1		0.2 U		**153**
PC305	RV	7	10/29/1993				0.25 U			6				**117**
PC305	RV	7	12/01/1993				0.25 U			13				**107**
PC305	RV	7	12/21/1993				0.25 U			2.5 U				**124**

Data Summary Table
Pine Creek - segment PineCrkSeg03

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Total Metals (ug/l)														
PC305	RV	7	01/21/1994				0.25 U			2.5 U				105
PC305	RV	7	02/17/1994				0.25 U			2.5 U				91
PC305	RV	7	03/08/1994				0.25 U			2.5 U				133
PC305	RV	7	03/23/1994				0.25 U			2.5 U				117
PC305	RV	7	04/08/1994				0.25 U			2.5 U				96
PC305	RV	7	04/18/1994				0.25 U			2.5 U				60
PC305	RV	7	05/03/1994				1.3			2.5 U				74
PC305	RV	7	05/19/1994				0.25 U			6				76
PC305	RV	7	06/08/1994				0.25 U			5 J				83
PC305	RV	7	06/24/1994				0.3 J			2.5 U				68
PC305	RV	7	08/17/1994				0.5 J			2.5 U				89
PC305	RV	7	09/26/1994				0.25 U			8				99
PC305	RV	7	10/05/1994				0.25 U			2.5 U				100
PC305	RV	7	11/16/1994				0.25 U			2.5 U				110
PC305	RV	7	12/14/1994				0.25 U			2.5 U				129
PC305	RV	7	01/10/1995				1.4			24				374
PC305	RV	7	02/09/1995				1.1			10				225
PC305	RV	7	03/22/1995				2.2			9				218
PC305	RV	7	04/14/1995				2.5			5 J				178
PC305	RV	7	04/27/1995				1.2			2.5 U				110
PC305	RV	7	05/11/1995				1.4			2.5 U				96
PC305	RV	7	05/24/1995				0.8			2.5 U				84
PC305	RV	7	06/12/1995				0.5 J			5 J				87
PC305	RV	7	06/27/1995				0.25 U			2.5 U				87
PC305	RV	7	07/11/1995				0.25 U			2.5 U				86
PC305	RV	7	07/25/1995				0.25 U			2.5 U				89
PC305	RV	7	08/14/1995				0.25 U			2.5 U				102
PC305	RV	7	09/13/1995				0.25 U			8				104
PC305	RV	7	10/18/1995				0.25 U			2.5 U				107
PC305	RV	7	11/22/1995				0.6			2.5 U				112
PC305	RV	7	12/27/1995				1			2.5 U				157
PC305	RV	7	01/18/1996				0.7			8				138
PC305	RV	7	02/28/1996				0.6			5 J				406
PC305	RV	7	03/27/1996				0.6			5 J				199
PC305	RV	7	04/18/1996				0.25 U			13				134
PC305	RV	7	05/08/1996				0.5 J			6				131
PC305	RV	7	06/19/1996				0.6			10				108

Data Summary Table
Pine Creek - segment PineCrkSeg03

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Total Metals (ug/l)														
PC305	RV	7	07/24/1996				0.8			7				102
PC305	RV	7	08/21/1996				0.25 U			5 J				104
PC305	RV	7	09/26/1996				0.25 U			7				111
PC305	RV	7	10/29/1996				0.25			0.25				104
PC305	RV	7	11/26/1996				0.5			5				147
PC313	RV	7	12/17/1996				0.6			6				156
PC313	RV	7	01/29/1997				0.5			2.5				139
PC313	RV	7	02/19/1997				8.6			19				169
PC313	RV	7	03/27/1997				0.7			14				159
PC313	RV	7	04/17/1997				1			8				146
PC313	RV	7	05/15/1997				0.8			37				122
PC313	RV	7	06/24/1997				0.25			2.5				76
PC313	RV	7	07/23/1997				0.5			7				117
PC313	RV	7	11/24/1997				0.6			2.5				115
PC313	RV	7	12/18/1997				1.8			6				161
PC313	RV	7	01/22/1998				8.5			200				1200
PC313	RV	7	02/25/1998				0.25			2.5				116
PC313	RV	7	03/20/1998				0.25			2.5				115
PC313	RV	7	04/24/1998				2.5			8				66
PC313	RV	7	05/25/1998				0.5			5 U				102
PC313	RV	7	06/25/1998				0.6			5 U				121
PC313	RV	3	05/14/1998		1.2	2 U	0.2	2 U	23	0.4	5 U	0.2 U	0.2 U	62
PC313	RV	11	11/16/1998		9.3	0.41 J	0.2 U	0.44 U	6.9 U	1.4 J	2.5 U	0.2 U	4.5 U	97.7
PC313	RV	23	12/03/1999		2 U	1 U	0.5 U	5 U	25 U	0.62 J	5 U	0.2 U	5 U	115
PC314	RV	2	11/11/1997		0.67 U	0.16 U	0.069 U	0.49 J	34.9 U	0.67	4.3 J	0.1 U	0.22 U	70.3
PC314	RV	3	05/14/1998		0.4	2 U	0.2 U	2 U	58	0.6	8	0.2 U	0.2 U	66
PC315	RV	2	11/04/1997		3.6 J	0.39 J	0.29 J	0.36 J	5 U	0.62	3.7 J	0.1 UJ	0.22 U	106
PC315	RV	2	11/11/1997		4.4 J	0.3 UJ	0.26 J	0.51 J	10.9 U	0.39 J	3 J	0.1 U	0.22 U	98.6
PC315	RV	18	05/25/1999						970	30	2.7			80
PC315	RV	3	05/14/1998		1.1	2 U	0.5	2 U	28	2.3	5 U	0.2 U	0.2 U	66
PC315	RV	3	05/18/1998		0.5 U	1 U	0.32	3 U	20 U	1.1	5 U	0.2 U	0.3 U	70.4
PC329	SP	2	11/13/1997		2.3 J	1	3.7	2.8 J	128	37.7	144	0.1 U	0.22 U	1470
PC329	SP	3	05/12/1998		1.1	1 U	1.2	3 U	23.5	11.8	18.1	0.2 U	0.3 U	306
PC330	AD	2	11/13/1997		1 U	2	0.72	0.94 J	891	3.4	183	0.1 U	0.22 U	438
PC330	AD	7	08/14/1997				0.5			2.5				142
PC330	AD	7	09/03/1997				0.5			2.5				125
PC330	AD	7	10/16/1997				0.6			2.5				148

Data Summary Table
Pine Creek - segment PineCrkSeg03

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Total Metals (ug/l)														
PC330	AD	7	07/27/1998				0.5			5 U				**110**
PC330	AD	7	08/25/1998				0.5			5 U				**118**
PC330	AD	7	09/24/1998				0.5			5 U				**128**
PC330	AD	7	10/26/1998				0.5			5 U				**136**
PC330	AD	7	11/24/1998				1.2			5 U				**172**
PC330	AD	7	01/15/1999				0.8			13				**115**
PC330	AD	7	02/22/1999				0.6			5 U				**147**
PC330	AD	7	03/08/1999				0.6			5 U				**145**
PC330	AD	3	05/12/1998			1		3 U		0.5 U		0.2 U	0.3 U	
PC330	AD	3	05/12/1998		0.76		0.21		298		**60.7**			**205**
PC331	AD	2	11/14/1997		1.9 U	2.2	0.069 U	0.62 U	28.8 U	2.9	3.8 J	0.1 U	0.22 U	**52.8 J**
PC331	AD	3	05/12/1998		1.7	2.2	0.17	3 U	32	2.6	5 U	0.2 U	0.3 U	**47.9**
PC339	RV	18	10/21/1998				1 UJ			1				
PC339	RV	18	11/19/1998				1 UJ			1				**140**
PC339	RV	18	12/09/1998				1 UJ			1				**140**
PC339	RV	18	12/29/1998				1 UJ			2				
PC339	RV	18	02/24/1999				1 UJ			14				**150**
PC339	RV	18	04/20/1999				1 UJ			4				**130**
PC339	RV	18	05/06/1999						10 U	1	1			**90**
PC339	RV	18	05/19/1999						20	1	1			**70**
PC339	RV	18	05/25/1999						**890**	**31**	**54**			**80**
PC339	RV	18	05/27/1999						110	4	7			**40**
PC339	RV	18	06/01/1999						20	1	1			**40**
PC339	RV	18	06/16/1999							1				30
PC339	RV	18	07/20/1999											**84**
PC339	RV	18	08/11/1999											**94.3**
PC339	RV	18	08/31/1999							0.59				**102**
PC339	RV	3	05/16/1998		0.44 U	0.23 U	0.25 J	0.44 U	30.9 J	0.69 J	1.7 J	0.16 U	0.042 U	**86.8**
PC7500	AD	13	07/15/1994		1 U	2 U	0.3 U	0.3 U	235	1 U	26.8	0.2 U	0.4 U	**90.4**
PC7501	RV	13	07/15/1994		1 U	2 U	**3.7**	0.3 U	153	**21.8**	0.1 U	0.2 U	0.4 U	**443**
PC7503	RV	13	07/15/1994		1 U	2 U	0.3 U	0.3 U	122	2.1	0.1 U	0.2 U	0.4 U	**121**
PC7504	RV	13	07/15/1994		1 U	2 U	0.3 U	0.3 U	92.1	1 U	0.1 U	0.2 U	0.4 U	**135**
PC7505	AD	13	07/15/1994		1 U	2 U	0.3 U	0.3 U	5 U	1 U	0.1 U	0.2 U	0.4 U	**72.6**
PC7602	SP	13	07/18/1994		1 U	2 U	**6.6**	**10.9**	5 U	2.4	13.9	0.2 U	0.4 U	**1430**
PC7602	SP	13	11/18/1994		1 U	2 U	**6.7**	**5.3**	5 U	1 U	7.1	0.2 U	0.4 U	**1420**

Surface Water - Dissolved Metals (ug/l)

Data Summary Table
Pine Creek - segment PineCrkSeg03

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Dissolved Metals (ug/l)														
PC100	RV	11	11/16/1998		0.83 U	0.2 U	**1.2**	0.32 U	6.9 U	0.39 J	1.5 U	0.2 U	4.5 U	**231**
PC305	RV	6	02/17/1998		50 U	5 U	4 U	12 U		3 U		0.2 U		**230**
PC305	RV	6	10/12/1997		50 U	5 U	**5 J**	12 U		3 U		0.2 U		**80**
PC305	RV	6	04/24/1997		45 U	4.5 U	3 U	3 U		1.5 U		0.2 U		**111**
PC305	RV	6	02/04/1997		45 U	1.5 U	3 U	3 U		1.5 U		0.2 U		**128**
PC305	RV	7	10/29/1993				0.25 U			**6**				**131**
PC305	RV	7	12/01/1993				0.25 U			1.5 U				**108**
PC305	RV	7	12/21/1993				0.25 U			1.5 U				**115**
PC305	RV	7	01/21/1994				0.25 U			1.5 U				**103**
PC305	RV	7	02/17/1994				0.25 U			1.5 U				**95**
PC305	RV	7	03/08/1994				**0.6**			1.5 U				**135**
PC305	RV	7	03/23/1994				0.25 U			1.5 U				**121**
PC305	RV	7	04/08/1994				0.25 U			1.5 U				**104**
PC305	RV	7	04/18/1994				0.25 U			1.5 U				**57**
PC305	RV	7	05/03/1994				**0.7**			1.5 U				**71**
PC305	RV	7	05/19/1994				0.25 U			1.5 U				**73**
PC305	RV	7	06/08/1994				0.25 U			1.5 U				**86**
PC305	RV	7	06/24/1994				**0.4 J**			1.5 U				**78**
PC305	RV	7	08/17/1994				0.25 U			**2.5 J**				**89**
PC305	RV	7	09/26/1994				0.25 U			1.5 U				**100**
PC305	RV	7	10/05/1994				0.25 U			1.5 U				**98**
PC305	RV	7	11/16/1994				0.25 U			1.5 U				**129**
PC305	RV	7	12/14/1994				0.25 U			1.5 U				**124**
PC305	RV	7	01/10/1995				**1.5**			**5**				**402**
PC305	RV	7	02/09/1995				**0.9**			1.5 U				**224**
PC305	RV	7	03/22/1995				**1.2**			**4**				**202**
PC305	RV	7	04/14/1995				**1**			1.5 U				**152**
PC305	RV	7	04/27/1995				**3.2**			1.5 U				**104**
PC305	RV	7	05/11/1995				**2**			**3 J**				**77**
PC305	RV	7	05/24/1995				**0.5 J**			1.5 U				**82**
PC305	RV	7	06/12/1995				0.25 U			1.5 U				**85**
PC305	RV	7	06/27/1995				0.25 U			1.5 U				**88**
PC305	RV	7	07/11/1995				0.3 J			1.5 U				**85**
PC305	RV	7	07/25/1995				0.25 U			**4**				**89**
PC305	RV	7	08/14/1995				0.25 U			1.5 U				**101**
PC305	RV	7	09/13/1995				0.25 U			**4**				**97**
PC305	RV	7	10/18/1995				0.25 U			**2.5 J**				**105**

Data Summary Table
Pine Creek - segment PineCrkSeg03

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Dissolved Metals (ug/l)														
PC305	RV	7	11/22/1995				**0.6**			1.5 U				**123**
PC305	RV	7	12/27/1995				**0.8**			1.5 U				**149**
PC305	RV	7	01/18/1996				**1.1**			**4**				**127**
PC305	RV	7	02/28/1996				**0.604**			1.5 U				**198**
PC305	RV	7	03/27/1996				**0.7**			**3 J**				**280**
PC305	RV	7	04/18/1996				0.25 U			**11**				**129**
PC305	RV	7	05/08/1996				**0.5 J**			**4**				**152**
PC305	RV	7	06/19/1996				**0.6**			**5**				**186**
PC305	RV	7	07/24/1996				**0.8**			**5**				**106**
PC305	RV	7	08/21/1996				0.25 U			1.5 U				**97**
PC305	RV	7	09/26/1996				**0.9**			1.5 U				**114**
PC305	RV	7	10/29/1996				0.25			0.15				**99**
PC305	RV	7	11/26/1996				0.25			**3**				**157**
PC313	RV	7	12/17/1996				**0.8**			**1.5**				**167**
PC313	RV	7	01/29/1997				0.25			**1.5**				**124**
PC313	RV	7	02/19/1997				**2.4**			**4**				**157**
PC313	RV	7	03/27/1997				**0.6**			**3**				**146**
PC313	RV	7	04/17/1997				**1.7**			**3**				**144**
PC313	RV	7	05/15/1997				**1.2**			**1.5**				**72**
PC313	RV	7	06/24/1997				0.25			**2.5**				**74**
PC313	RV	7	07/23/1997				**0.5**			**1.5**				**124**
PC313	RV	7	11/24/1997				**0.5**			**1.5**				**113**
PC313	RV	7	12/18/1997				**0.8**			**3**				**130**
PC313	RV	7	01/22/1998				**8.6**			**36**				**1210**
PC313	RV	7	02/25/1998				**0.5**			**1.5**				**117**
PC313	RV	7	03/20/1998				0.25			**1.5**				**105**
PC313	RV	7	04/24/1998				**2.2**			**3**				**66**
PC313	RV	7	05/25/1998				**0.5**			3 U				**100**
PC313	RV	7	06/25/1998				**0.7**			**8**				**128**
PC313	RV	3	05/14/1998		1.2	2 U	0.2	2 U	20 U	0.3	5 U	0.2 U	0.2 U	**62**
PC313	RV	11	11/16/1998		**8.7**	0.27 J	0.19 U	0.31 U	6.9 U	0.36 J	2 U	0.2 U	4.5 U	**96.8**
PC313	RV	23	12/03/1999		2 U	1 U	0.5 U	5 U	25 U	0.5 U	5 U	0.2 U	5 U	**114**
PC314	RV	2	11/11/1997		0.5	0.18	0.042	0.5 U	19	0.29	3.8	0.2 U	0.03 U	**62.4**
PC314	RV	3	05/14/1998		0.5	2 U	0.2	2 U	27	0.2	7	0.2 U	0.2 U	**64**
PC315	RV	2	11/04/1997		**3.4**	0.35	**0.4**	0.5 U	10 U	0.27	2.6	0.2 U	0.03 U	**102**
PC315	RV	2	11/11/1997		**4**	0.21	0.26	0.5 U	10 U	0.22	1.3	0.2 U	0.03 U	**93.8**
PC315	RV	18	05/25/1999				1 U		970	1 U	**54**			40

Data Summary Table
Pine Creek - segment PineCrkSeg03

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X
Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Dissolved Metals (ug/l)														
PC315	RV	3	05/14/1998		1.1	2 U	**0.4**	2 U	46	0.8	5 U	0.2 U	0.2 U	**68**
PC315	RV	3	05/18/1998		0.5 U	1 U	0.33	3 U	20 U	0.51	5 U	0.2 U	0.3 U	**69.6**
PC329	SP	2	11/13/1997		2.1	0.96	**4.14**	2.7	104	**42.3**	**148**	0.2 U	0.03 U	**1410**
PC329	SP	3	05/12/1998		1.1	1 U	**1.3**	3 U	20 U	**7.6**	17.8	0.2 U	0.3 U	**301**
PC330	AD	2	11/13/1997		0.52	0.76	**0.53**	0.5 U	13	0.12	**139**	0.2 U	0.03 U	**349**
PC330	AD	7	08/14/1997				**0.5**			**3**				**133**
PC330	AD	7	09/03/1997				**0.5**			**1.5**				**142**
PC330	AD	7	10/16/1997				**0.6**			**1.5**				**164**
PC330	AD	7	07/27/1998				**0.5**			3 U				**108**
PC330	AD	7	08/25/1998				**0.5**			3 U				**115**
PC330	AD	7	09/24/1998				0.5 U			3 U				**136**
PC330	AD	7	10/26/1998				**0.5**			3 U				**139**
PC330	AD	7	11/24/1998				**1.1**			3 U				**177**
PC330	AD	7	01/15/1999				**0.7**			3 U				**110**
PC330	AD	7	02/22/1999				**0.8**			3 U				**151**
PC330	AD	7	03/08/1999				**0.6**			3 U				**145**
PC330	AD	3	05/12/1998		0.73	1 U	0.2	3 U	20 U	0.5 U	**50.5**	0.2 U	0.3 U	
PC330	AD	3	05/12/1998											**192**
PC331	AD	2	11/14/1997		1.7	2.4	0.096	0.57	10 U	0.9	1.4	0.2 U	0.03 U	37.2
PC331	AD	3	05/12/1998		1.7	2	0.13	3 U	20 U	0.5 U	5 U	0.2 U	0.3 U	39.2
PC339	RV	18	10/21/1998				1 UJ			1 UJ				**140**
PC339	RV	18	11/19/1998				1 UJ			1 UJ				**140**
PC339	RV	18	12/09/1998				1 UJ			1 UJ				**139**
PC339	RV	18	12/29/1998				1 UJ			1				**168**
PC339	RV	18	02/24/1999				1 UJ			1				**135**
PC339	RV	18	04/20/1999				1 UJ			1				**122**
PC339	RV	18	05/06/1999				1 U		10 U	1 U	1 U			**95**
PC339	RV	18	05/19/1999				1 U		10 U	1 U	1 U			**68**
PC339	RV	18	05/25/1999				1 U		6	1 U	2			39
PC339	RV	18	05/27/1999				1 U		10 U	1 U	1 U			40
PC339	RV	18	06/01/1999				1 U		10 U	1 U	1 U			40
PC339	RV	18	06/16/1999				**1**			1				35
PC339	RV	18	07/20/1999				1 U			1 U				**87**
PC339	RV	18	08/11/1999				1 U			1 U				**96**
PC339	RV	18	08/31/1999				1 U			1 U				**108**
PC339	RV	3	05/16/1998		0.5 U	0.23 U	0.28 J	0.44 U	38.8 J	0.7 J	1.6 J	0.16 U	0.042 UJ	**87.2 J**
PC7656	RV	13	---			4 U	0.6 U	0.6 U	18	0.702	1.2			**260**

Data Summary Table
Pine Creek - segment PineCrkSeg03

Boxed Sample Results Exceed Screening Level By More Than 1X

Shaded Sample Results Exceed Screening Level By More Than 10X

Shaded Results With (*) Exceed Screening Level By More Than 100X

Location	Location Type	Ref	Date	Depth In Feet	Antimony	Arsenic	Cadmium	Copper	Iron	Lead	Manganese	Mercury	Silver	Zinc
Surface Water - Dissolved Metals (ug/l)														
PC7656	RV	13	03/01/1993			4 U	0.6 U	0.6 U	24.8	**1.23**	1.1			**152**
PC7656	RV	13	08/01/1993			4 U	0.6 U	0.6 U	3.2	2 U	0.2 U			**147**
PC7657	RV	13	---			4 U	0.6 U	0.6 U	15	0.571	0.2 U			**189**
PC7657	RV	13	03/01/1993			4 U	0.6 U	0.6 U	17	0.598	0.2 U			**150**
PC7657	RV	13	08/01/1993			4 U	0.6 U	0.6 U	10 U	2 U	0.2 U			**148**
PC7658	RV	13	---			4 U	0.6 U	0.6 U	20	0.433	0.2 U			**197**
PC7658	RV	13	03/01/1993			4 U	0.6 U	3.1	15	0.677	0.2 U			**153**
PC7658	RV	13	08/01/1993				0.6 U	0.6 U	3.4	2 U	0.2 U			**165**
PC7698	RV	13	---			4 U	0.6 U	**3.8**	12	**1.97**	1.3			**228**
PC7698	RV	13	03/01/1993			4 U	0.6 U	0.6 U	17	0.744	0.2 U			**150**
PC7698	RV	13	08/01/1993				0.6 U	**3.6**	6.7	2 U	1.1			**152**

ATTACHMENT 3
Statistical Summary Tables for Metals

Statistical Summary of Total Metals Concentrations in Surface Soil
Segment PineCrkSeg01
Units: mg/kg

Analyte Name	Quantity Tested	Quantity Detected	Minimum Detected Value	Maximum Detected Value	Average Detected Value	Coefficient of Variation	Screening Level (SL)	Quantity Exceeding 1X the SL	Quantity Exceeding 10X the SL	Quantity Exceeding 100X the SL
Antimony	7	6	2.9	437	80.9	2.16	31.3	1	1	0
Arsenic	7	7	15.7	523	136	1.32	22	6	1	0
Cadmium	7	6	0.73	82.6	19.6	1.69	9.8	2	0	0
Copper	7	7	13.4	1,430	257	2.02	100	2	1	0
Iron	7	7	19,900	45,300	28,100	0.31	65,000	0	0	0
Lead	7	7	183	7,690	3,280	0.8	171	7	4	0
Manganese	7	7	37.4	1,940	987	0.56	3,597	0	0	0
Mercury	7	7	0.12	2.8	0.776	1.17	23.5	0	0	0
Silver	7	7	0.17	56.1	12	1.65	391	0	0	0
Zinc	7	7	254	8,990	2,390	1.36	280	6	2	0

Statistical Summary of Total Metals Concentrations in Subsurface Soil
Segment PineCrkSeg01
Units: mg/kg

Analyte Name	Quantity Tested	Quantity Detected	Minimum Detected Value	Maximum Detected Value	Average Detected Value	Coefficient of Variation	Screening Level (SL)	Quantity Exceeding 1X the SL	Quantity Exceeding 10X the SL	Quantity Exceeding 100X the SL
Antimony	5	5	3.1	23.9	11.4	0.68	31.3	0	0	0
Arsenic	5	5	18.3	181	84.4	1	22	3	0	0
Cadmium	5	4	8.5	34.7	15.8	0.8	9.8	2	0	0
Copper	5	4	22.6	197	77	1.05	100	1	0	0
Iron	5	5	20,000	128,000	53,200	0.85	65,000	1	0	0
Lead	5	5	847	6,960	3,050	0.83	171	5	3	0
Manganese	5	5	207	8,990	2,410	1.54	3,597	1	0	0
Mercury	5	5	1	4.4	2.98	0.47	23.5	0	0	0
Silver	5	5	0.76	10.4	5.53	0.71	391	0	0	0
Zinc	5	5	408	16,800	5,160	1.29	280	5	3	0

Statistical Summary of Total Metals Concentrations in Sediment
Segment PineCrkSeg01
Units: mg/kg

Analyte Name	Quantity Tested	Quantity Detected	Minimum Detected Value	Maximum Detected Value	Average Detected Value	Coefficient of Variation	Screening Level (SL)	Quantity Exceeding 1X the SL	Quantity Exceeding 10X the SL	Quantity Exceeding 100X the SL
Antimony	52	32	0.6	14.7	2.13	1.62	3.3	4	0	0
Arsenic	52	47	4.95	262	49.7	1.36	13.6	32	5	0
Cadmium	52	44	0.113	18.2	4.69	0.99	1.56	35	1	0
Copper	51	50	6.58	284	48.6	1.03	32.3	24	0	0
Iron	52	52	6,270	50,900	20,300	0.46	40,000	2	0	0
Lead	52	52	5.16	6,680	1,020	1.37	51.5	46	27	2
Manganese	52	52	16.1	1,400	645	0.53	1,210	5	0	0
Mercury	52	26	0.0521	1.6	0.349	1.21	0.179	12	0	0
Silver	52	42	0.175	26.6	2.72	1.61	4.5	4	0	0
Zinc	52	52	10	6,930	1,200	1.08	200	45	8	0

Statistical Summary of Total Metals Concentrations in Groundwater
Segment PineCrkSeg01
Units: ug/L

Analyte Name	Quantity Tested	Quantity Detected	Minimum Detected Value	Maximum Detected Value	Average Detected Value	Coefficient of Variation	Screening Level (SL)	Quantity Exceeding 1X the SL	Quantity Exceeding 10X the SL	Quantity Exceeding 100X the SL
Antimony	7	7	2.1	7.7	4.97	0.48	6	4	0	0
Arsenic	7	1	4	4	4	< 0.001	50	0	0	0
Cadmium	7	5	1	97.8	25.2	1.62	2	4	1	0
Copper	7	7	1.7	45.2	9.21	1.73	1	7	1	0
Iron	7	3	41.9	358	149	1.21	300	1	0	0
Lead	7	3	1.2	11.3	5	1.1	15	0	0	0
Manganese	7	7	9.3	1,390	243	2.09	50	3	1	0
Zinc	7	7	103	10,200	3,070	1.19	30	7	5	3

Statistical Summary of Total Metals Concentrations in Surface Water
Segment PineCrkSeg01
Units: ug/L

Analyte Name	Quantity Tested	Quantity Detected	Minimum Detected Value	Maximum Detected Value	Average Detected Value	Coefficient of Variation	Screening Level (SL)	Quantity Exceeding 1X the SL	Quantity Exceeding 10X the SL	Quantity Exceeding 100X the SL
Antimony	66	5	0.5	241	49.3	2.17	6	1	1	0
Arsenic	69	27	0.17	36.9	3.45	2.09	50	0	0	0
Cadmium	127	107	0.27	190	11.3	2.32	2	89	7	0
Copper	70	41	0.21	568	28.1	3.36	1	33	9	3
Iron	71	41	5.6	23,100	1,310	2.91	300	17	5	0
Lead	131	110	0.13	2,160	44.1	4.9	15	26	5	1
Manganese	71	42	0.6	2,610	333	1.84	50	21	11	0
Silver	63	2	0.22	10.7	5.46	1.36	100	0	0	0
Zinc	130	123	6.7	65,400	3,580	2.31	30	118	104	45

Statistical Summary of Dissolved Metals Concentrations in Surface Water
Segment PineCrkSeg01
Units: ug/L

Analyte Name	Quantity Tested	Quantity Detected	Minimum Detected Value	Maximum Detected Value	Average Detected Value	Coefficient of Variation	Screening Level (SL)	Quantity Exceeding 1X the SL	Quantity Exceeding 10X the SL	Quantity Exceeding 100X the SL
Antimony	36	12	0.5	267	23	3.34	2.92	1	1	0
Arsenic	113	28	0.1	33.1	2.26	2.73	150	0	0	0
Cadmium	175	116	0.38	226	13	2.4	0.38	115	55	6
Copper	115	46	0.26	1,070	44.7	3.94	3.2	22	4	2
Iron	112	67	2.5	11,700	516	3.26	1,000	8	1	0
Lead	175	131	0.08	2,560	52.1	5.82	1.09	106	17	4
Manganese	117	69	0.7	3,070	302	2.08	20.4	30	18	3
Silver	34	1	0.056	0.056	0.056	< 0.001	0.43	0	0	0
Zinc	177	171	3.8	73,600	3,440	2.66	42	145	121	34

Statistical Summary of Total Metals Concentrations in Surface Water
Segment PineCrkSeg02
Units: ug/L

Analyte Name	Quantity Tested	Quantity Detected	Minimum Detected Value	Maximum Detected Value	Average Detected Value	Coefficient of Variation	Screening Level (SL)	Quantity Exceeding 1X the SL	Quantity Exceeding 10X the SL	Quantity Exceeding 100X the SL
Copper	2	1	0.52	0.52	0.52	< 0.001	1	0	0	0
Iron	3	1	20	20	20	< 0.001	300	0	0	0
Lead	2	1	0.15	0.15	0.15	< 0.001	15	0	0	0
Manganese	2	1	2.3	2.3	2.3	< 0.001	50	0	0	0

Statistical Summary of Dissolved Metals Concentrations in Surface Water
Segment PineCrkSeg02
Units: ug/L

Analyte Name	Quantity Tested	Quantity Detected	Minimum Detected Value	Maximum Detected Value	Average Detected Value	Coefficient of Variation	Screening Level (SL)	Quantity Exceeding 1X the SL	Quantity Exceeding 10X the SL	Quantity Exceeding 100X the SL
Arsenic	5	1	0.11	0.11	0.11	< 0.001	150	0	0	0
Copper	5	1	5.2	5.2	5.2	< 0.001	3.2	1	0	0
Iron	6	3	10	18	15	0.29	1,000	0	0	0
Lead	6	2	0.18	0.367	0.274	0.48	1.09	0	0	0
Zinc	6	4	2.5	12	8.3	0.52	42	0	0	0

Statistical Summary of Total Metals Concentrations in Surface Soil
Segment PineCrkSeg03
Units: mg/kg

Analyte Name	Quantity Tested	Quantity Detected	Minimum Detected Value	Maximum Detected Value	Average Detected Value	Coefficient of Variation	Screening Level (SL)	Quantity Exceeding 1X the SL	Quantity Exceeding 10X the SL	Quantity Exceeding 100X the SL
Antimony	9	6	5.4	59.7	23.8	1.1	31.3	2	0	0
Arsenic	9	9	9.2	347	96.1	1.19	22	6	1	0
Cadmium	9	4	1.9	4	2.95	0.29	9.8	0	0	0
Copper	9	9	5.8	162	56.7	0.85	100	1	0	0
Iron	9	9	16,600	71,300	32,800	0.53	65,000	1	0	0
Lead	9	9	140	8,260	2,940	1.08	171	8	4	0
Manganese	9	9	93	1,070	571	0.57	3,597	0	0	0
Mercury	9	8	0.11	2.2	0.938	0.82	23.5	0	0	0
Silver	9	8	0.45	11.8	5.38	0.92	391	0	0	0
Zinc	9	9	64.8	1,030	579	0.48	280	8	0	0

Statistical Summary of Total Metals Concentrations in Subsurface Soil
Segment PineCrkSeg03
Units: mg/kg

Analyte Name	Quantity Tested	Quantity Detected	Minimum Detected Value	Maximum Detected Value	Average Detected Value	Coefficient of Variation	Screening Level (SL)	Quantity Exceeding 1X the SL	Quantity Exceeding 10X the SL	Quantity Exceeding 100X the SL
Antimony	6	4	4.2	20.6	12.8	0.58	31.3	0	0	0
Arsenic	6	6	17.6	227	95.4	0.88	22	5	1	0
Cadmium	6	5	7	122	46.1	1.01	9.8	3	1	0
Copper	6	6	24.9	779	327	0.91	100	5	0	0
Iron	6	6	12,100	103,000	42,500	0.87	65,000	2	0	0
Lead	6	6	331	4,290	1,750	0.86	171	6	3	0
Manganese	6	6	18.6	988	481	0.98	3,597	0	0	0
Mercury	6	6	0.14	4.6	1.22	1.44	23.5	0	0	0
Silver	6	6	0.27	7.7	2.57	1.11	391	0	0	0
Zinc	6	6	113	16,900	5,600	1.15	280	5	3	0

Statistical Summary of Total Metals Concentrations in Sediment
Segment PineCrkSeg03
Units: mg/kg

Analyte Name	Quantity Tested	Quantity Detected	Minimum Detected Value	Maximum Detected Value	Average Detected Value	Coefficient of Variation	Screening Level (SL)	Quantity Exceeding 1X the SL	Quantity Exceeding 10X the SL	Quantity Exceeding 100X the SL
Antimony	22	12	0.92	31.8	7.42	1.62	3.3	3	0	0
Arsenic	22	22	2.79	60.6	17.7	0.87	13.6	10	0	0
Cadmium	22	22	0.38	1.7	0.921	0.38	1.56	2	0	0
Copper	22	22	10.1	41.6	19.2	0.42	32.3	1	0	0
Iron	22	22	9,170	24,200	15,900	0.26	40,000	0	0	0
Lead	22	22	24.8	738	198	0.72	51.5	21	1	0
Manganese	22	22	127	739	405	0.39	1,210	0	0	0
Mercury	22	5	0.0478	0.13	0.0694	0.49	0.179	0	0	0
Silver	22	18	0.344	0.993	0.633	0.29	4.5	0	0	0
Zinc	22	22	128	516	298	0.32	200	19	0	0

Statistical Summary of Total Metals Concentrations in Groundwater
Segment PineCrkSeg03
Units: ug/L

Analyte Name	Quantity Tested	Quantity Detected	Minimum Detected Value	Maximum Detected Value	Average Detected Value	Coefficient of Variation	Screening Level (SL)	Quantity Exceeding 1X the SL	Quantity Exceeding 10X the SL	Quantity Exceeding 100X the SL
Antimony	8	4	1.6	7.7	4.8	0.67	6	2	0	0
Arsenic	8	1	1	1	1	< 0.001	50	0	0	0
Cadmium	8	3	0.52	1.4	0.817	0.62	2	0	0	0
Copper	8	6	1.2	166	52.6	1.45	1	6	2	2
Iron	8	4	56.5	2,080	1,100	0.9	300	3	0	0
Lead	8	4	0.73	16.6	8.68	0.91	15	1	0	0
Manganese	8	6	2	262	89.3	1.42	50	2	0	0
Zinc	8	8	26.2	2,420	679	1.56	30	7	2	0

Statistical Summary of Dissolved Metals Concentrations in Groundwater
Segment PineCrkSeg03
Units: ug/L

Analyte Name	Quantity Tested	Quantity Detected	Minimum Detected Value	Maximum Detected Value	Average Detected Value	Coefficient of Variation	Screening Level (SL)	Quantity Exceeding 1X the SL	Quantity Exceeding 10X the SL	Quantity Exceeding 100X the SL
Antimony	8	2	7.6	7.8	7.7	0.02	2.92	2	0	0
Arsenic	8	1	0.14	0.14	0.14	< 0.001	150	0	0	0
Cadmium	8	2	0.53	6	3.27	1.18	0.38	2	1	0
Manganese	3	1	5.7	5.7	5.7	< 0.001	20.4	0	0	0
Mercury	8	1	0.2	0.2	0.2	< 0.001	0.77	0	0	0
Zinc	8	8	26.5	160	74.8	0.64	42	5	0	0

Statistical Summary of Total Metals Concentrations in Surface Water
Segment PineCrkSeg03
Units: ug/L

Analyte Name	Quantity Tested	Quantity Detected	Minimum Detected Value	Maximum Detected Value	Average Detected Value	Coefficient of Variation	Screening Level (SL)	Quantity Exceeding 1X the SL	Quantity Exceeding 10X the SL	Quantity Exceeding 100X the SL
Antimony	29	10	0.4	9.3	2.59	1.03	6	1	0	0
Arsenic	29	8	0.29	2.2	1.19	0.7	50	0	0	0
Cadmium	107	63	0.17	8.6	1.27	1.44	2	9	0	0
Copper	29	8	0.36	10.9	3.06	1.18	1	4	1	0
Iron	31	19	20	970	222	1.44	300	3	0	0
Lead	115	75	0.25	200	9.61	2.48	15	8	1	0
Manganese	31	19	1	183	28.7	1.77	50	4	0	0
Zinc	115	115	30	1,470	170	1.42	30	114	9	0

Statistical Summary of Dissolved Metals Concentrations in Surface Water
Segment PineCrkSeg03
Units: ug/L

Analyte Name	Quantity Tested	Quantity Detected	Minimum Detected Value	Maximum Detected Value	Average Detected Value	Coefficient of Variation	Screening Level (SL)	Quantity Exceeding 1X the SL	Quantity Exceeding 10X the SL	Quantity Exceeding 100X the SL
Antimony	21	13	0.5	8.7	2.1	1.08	2.92	3	0	0
Arsenic	31	8	0.18	2.4	0.891	0.97	150	0	0	0
Cadmium	121	65	0.042	8.6	0.972	1.34	0.38	50	3	0
Copper	33	5	0.57	3.8	2.75	0.47	3.2	2	0	0
Iron	35	19	3.2	970	72.4	3.02	1,000	0	0	0
Lead	121	60	0.12	42.3	3.52	2	1.09	37	3	0
Manganese	35	16	1.1	148	27.1	1.79	20.4	4	0	0
Zinc	121	121	35	1,410	146	1.12	42	114	2	0

ATTACHMENT 4
Screening Levels

SCREENING LEVELS

Based on the results of the human health and ecological risk assessments, 10 chemicals of potential concern (COPCs) were identified for inclusion and evaluation in the RI. The COPCs and appropriate corresponding media (soil, sediment, groundwater, and surface water) are summarized in Table 1. For each of the COPCs listed in Table 1, a screening level was selected.

The screening levels were used in the RI to help identify source areas and media of concern that would be carried forward for evaluation in the feasibility study (FS). The following paragraphs discuss the rationale for the selection of the screening levels.

Applicable risk-based screening levels and background concentrations were compiled from available federal numeric criteria (e.g., National Ambient Water Quality Criteria), regional preliminary remediation goals (PRGs) (e.g., EPA Region IX PRGs), regional background studies for soil, sediment, and surface water, and other guidance documents (e.g., National Oceanographic and Atmospheric Administration freshwater sediment screening values). Selected RI screening levels are listed in Tables 2 through 4.

For the evaluation of site soil, sediment, groundwater, and surface water chemical data, the lowest available risk-based screening level for each media was selected as the screening level. If the lowest risk-based screening level was lower than the available background concentration, the background concentration was selected as the screening level.

Groundwater data are screened against surface water screening levels to evaluate the potential for impacts to surface water from groundwater discharge.

For site groundwater and surface water, total and dissolved metals data are evaluated separately. Risk-based screening levels for protection of human health (consumption of water) are based on total metals results, therefore, total metals data for site groundwater and surface water were evaluated against screening levels selected from human health risk-based screening levels. Risk-based screening levels for protection of aquatic life are based on dissolved metals results, therefore, dissolved metals data for site groundwater and surface water were evaluated against screening levels selected from aquatic life risk-based screening levels.

Table 1
Chemicals of Potential Concern

Chemical	Human Health COPC			Ecological COPC		
	Soil/Sediment	Groundwater	Surface Water	Soil	Sediment	Surface Water
Antimony	X	X				
Arsenic	X	X	X	X	X	
Cadmium	X	X	X	X	X	X
Copper				X	X	X
Iron	X					
Lead	X	X	X	X	X	X
Manganese	X		X			
Mercury			X		X	
Silver					X	
Zinc	X	X	X	X	X	X

Table 2
Selected Screening Levels for Groundwater and Surface Water—Coeur d'Alene River Basin and Coeur d'Alene Lake

Chemical	Surface Water Total (µg/L)	Surface Water Dissolved (µg/L)	Groundwater Total (µg/L)	Groundwater Dissolved (µg/L)
Antimony	6[a]	2.92[b]	6[a]	2.92[b]
Arsenic	50[a]	150[c,d]	50[a]	150[c,d]
Cadmium	2[e]	0.38[b]	2[e]	0.38[b]
Copper	1[e]	3.2[c,d]	1[e]	3.2[c,d]
Iron	300[a]	1,000[c,d]	300[a]	1,000[c,d]
Lead	15[a]	1.09[b]	15[a]	1.09[b]
Manganese	50[a]	20.4[b]	50[a]	20.4[b]
Mercury	2[a]	0.77[c,d]	2[a]	0.77[c,d]
Silver	100[a]	0.43[c,d]	100[a]	0.43[c,d]
Zinc	30[e]	42[c,d]	30[e]	42[c,d]

[a]40 CFR 141 and 143. National Primary and Secondary Drinking Water Regulations. U.S. EPA Office of Water. Office of Groundwater and Drinking Water. http://www.epa.gov/OGWDW/wot/appa.html. October 18, 1999.
[b]Dissolved surface water 95th percentile background concentrations calculated from URS project database.
[c]Freshwater NAWQC for protection of aquatic life are expressed in terms of the dissolved metal in the water column.
[d]Freshwater NAWQC for cadmium, copper, lead, silver, and zinc are expressed as a function of hardness (mg/L of CaCO3) in the water column.
Values above correspond to a hardness value of 30 mg/L.
[e]Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota: 1996 Revision. U.S. Department of
Energy. Office of Environmental Management. ES/ER/TM-96/R2. Value based on total metals concentration.

Note:
µg/L - microgram per liter

Table 3
Selected Screening Levels for Surface Water—Spokane River Basin

Chemical	SpokaneRSeg01		SpokaneRSeg02		SpokaneRSeg03	
	Surface Water Total (µg/L)	Surface Water Dissolved (µg/L)	Surface Water Total (µg/L)	Surface Water Dissolved (µg/L)	Surface Water Total (µg/L)	Surface Water Dissolved (µg/L)
Antimony	6[a]	2.92[b]	6[a]	2.92[b]	6[a]	2.92[b]
Arsenic	50[a]	150[c]	50[a]	150[c]	50[a]	150[c]
Cadmium	2[e]	0.38[b]	2[e]	0.38[b]	2[e]	0.38[b]
Copper	1[e]	2.3[c,d]	1[e]	3.8[c,d]	1[e]	5.7[c,d]
Iron	300[a]	1,000[c]	300[a]	1,000[c]	300[a]	1,000[c]
Lead	15[a]	1.09[b]	15[a]	1.09[b]	15[a]	1.4[c,d]
Manganese	50[a]	20.4[b]	50[a]	20.4[b]	50[a]	20.4[b]
Mercury	2[a]	0.77[c]	2[a]	0.77[c]	2[a]	0.77[c]
Silver	100[a]	0.22[c,d]	100[a]	0.62[c,d]	100[a]	1.4[c,d]
Zinc	30[e]	30[c,d]	30[e]	50[c,d]	30[e]	75[c,d]

[a]40 CFR 141 and 143. National Primary and Secondary Drinking Water Regulations. U.S. EPA Office of Water. Office of Groundwater and Drinking Water. http://www.epa.gov/OGWDW/wot/appa.html. October 18, 1999.
[b]Dissolved surface water 95th percentile background concentrations calculated from URS project database. Technical Memorandum. Estimation of Background Concentration in Soils, Sediments, and Surface Waters. Coeur d'Alene Basin RI/FS. URS. May 2001.
[c]Freshwater NAWQC for protection of aquatic life are expressed in terms of the dissolved metal in the water column.
[d]Freshwater NAWQC for cadmium, copper, lead, silver, and zinc are expressed as a function of hardness (mg/L of $CaCO_3$) in the water column.
[e]Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota: 1996 Revision. U.S. Department of Energy. Office of Environmental Management. ES/ER/TM-96/R2. Value based on total metals concentration.

Note:
µg/L - microgram per liter

Table 4
Selected Screening Levels—Soil and Sediment

Chemical	Upper Coeur d'Alene River Basin		Lower Coeur d'Alene River Basin		Spokane River Basin	
	Soil (mg/kg)	Sediment (mg/kg)	Soil (mg/kg)	Sediment (mg/kg)	Soil (mg/kg)	Sediment (mg/kg)
Antimony	31.3[a]	3.30[b]	31.3[a]	3[c]	31.3[a]	3[c]
Arsenic	22[b]	13.6[b]	12.6[b]	12.6[b]	9.34[b]	9.34[b]
Cadmium	9.8[d]	1.56[b]	9.8[d]	0.678[b]	9.8[d]	0.72[b]
Copper	100[d]	32.3[b]	100[d]	28[c]	100[d]	28[c]
Iron	65,000[b]	40,000[c]	27,600[b]	40,000[c]	25,000[b]	40,000[c]
Lead	171[b]	51.5[b]	47.3[b]	47.3[b]	14.9[b]	14.9[b]
Manganese	3,597[b]	1,210[b]	1,760[a]	630[c]	1,760[a]	663[b]
Mercury	23.5[a]	0.179[b]	23.5[a]	0.179[b]	23.5[a]	0.174[c]
Silver	391[a]	4.5[c]	391[a]	4.5[c]	391[a]	4.5[c]
Zinc	280[b]	200[b]	97.1[b]	97.1[b]	66.4[b]	66.4[b]

[a]U.S. EPA Region IX Preliminary Remediation Goals for Residential or Industrial Soil http://www.epa.gov/region09/wasate/sfund/prg. February 3, 2000.
[b]Technical Memorandum. Estimation of Background Concentration in Soils, Sediments, and Surface Waters. Coeur d'Alene Basin RI/FS. URS. May 2001.
[c]Values as presented in National Oceanographic and Atmospheric Administration Screening Quick Reference Tables, NOAA HAZMAT Report 99-1, Seattle, WA. M. F. Buchman, 1999. Values generated from numerous reference documents.
[d]Final Ecological Risk Assessment. Coeur d'Alene Basin RI/FS. Prepared by CH2M HILL/URS for EPA Region 10. May 18, 2001. Values are the lowest of the NOAEL-based PRGs for terrestrial biota (Table ES-3).

Note:
mg/kg - milligram per kilogram